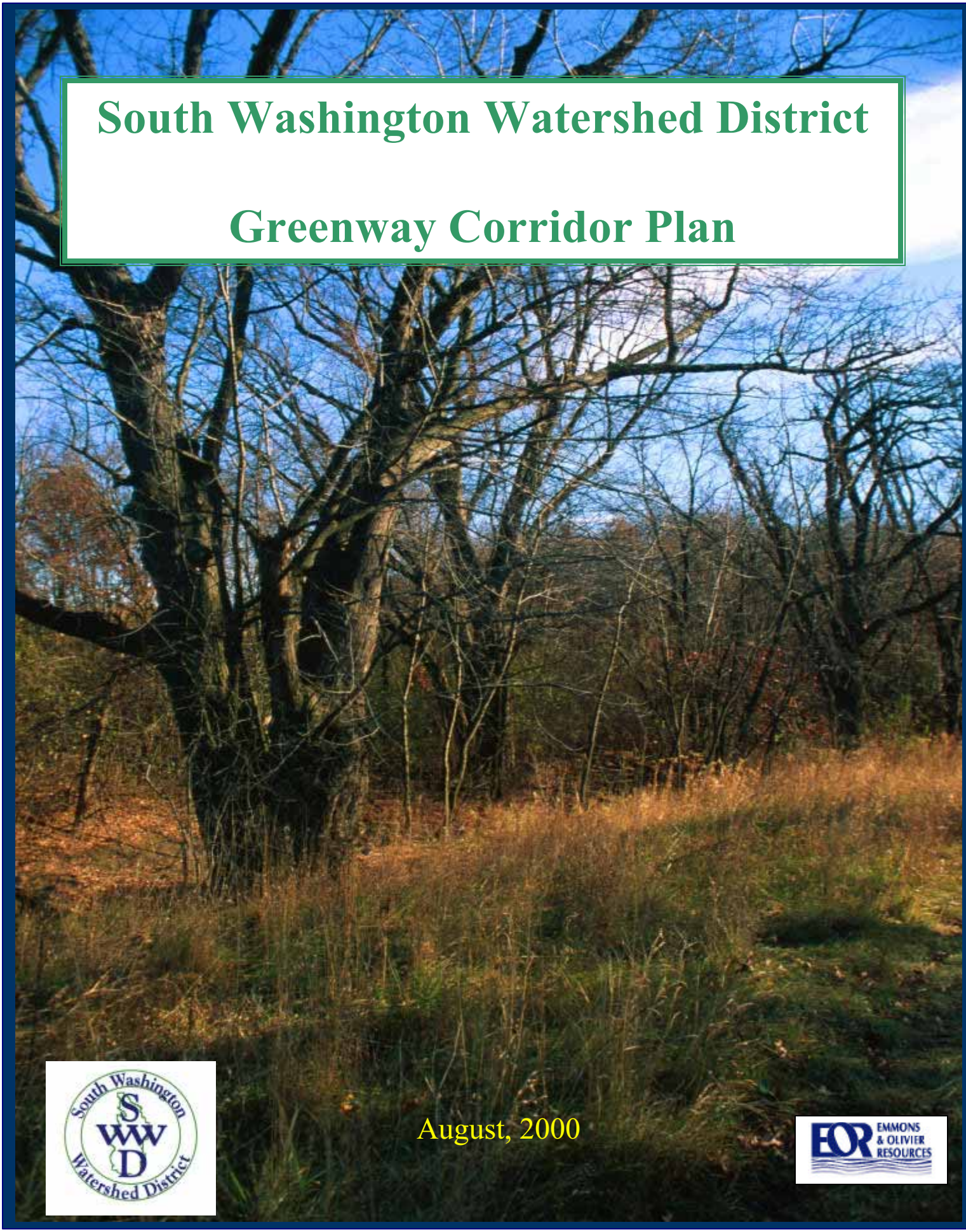
South Washington Watershed District

Greenway Corridor Plan



August, 2000

EMMONS & OLIVIER RESOURCES

Date: July 28, 2000

TO: SWWD CAC – Greenways Planning Group

FROM: Tony DeMars, Natural Resource Specialist
Jason Naber, GIS Specialist

RE: SWWD Greenway Corridor, Final Report

Attached is the Final Report for the SWWD Greenway Corridor. This report defines the geographic location of the Corridor, describes the biological and physical features and sets forth a framework for implementation. The SWWD CAC provided valuable input throughout the planning process and in the review of the Draft Report. This Final Report incorporates those suggestions and some additional enhancements. The following summarizes key changes to the Draft Report:

Acknowledgements are included to provide appropriate credits

Section I. Introduction: The introduction is revised to provide better rational for the importance of the Corridor as well as an overview of major report sections.

Section II. Defining and Evaluating the Corridor: The title of this section, which was changed from *Project Approach*, is rewritten to provide a better understanding of the planning process used to develop this the Greenway Corridor Plan. Two additional sections are included that describe *Missing Links* and *Protection Areas.*

Section III. Corridor Segment Description: Some additional text was added, describing the mapping and data for segments. Additional information on the Gables Lake segment was also added. Some follow-up field survey work has identified a small area of remnant oak savanna with good restoration potential.

Section IV. Recommendations: Several enhancements or changes to this section have been made:

- Deer Reflectors suggested for road crossings.
- Text on land protection tools including conservation easements, purchased development rights, transferred development rights, park dedication, land acquisition and miscellaneous easements.
- For recommendations suggesting use of *Neighborhood Wilds,* clarification on the current lack of funding is provided.

- Additional text recommending restoration of an oak savanna in the Gables Lake West corridor segment.

Several of the maps have been discarded where overlap with other maps occurred. We reworked the presettlement land cover map for easier use as a guide to native plant community establishment. The appendices, which remain the same, are not included in this mailing.

Proposed Outcome for Final CAC Greenway Planning Meeting
The final piece of the report that remains to be completed is a summary of recommendations and implementation schedule. While we have described in detail suggested actions for each corridor segment and suggested priorities and key protection areas, specific steps and time lines have not been established.

During the August 3rd CAC Meeting, we will review sections of the report suggesting what the next steps might be and define priorities and an implementation time frame (to the degree possible). This input from the CAC will serve as the basis for the executive summary and recommendations section to be submitted to the SWWD Board at the August 8th Board Meeting.

Please call me, if you have any questions.

South Washington Watershed District
Greenway Corridor Plan

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Acknowledgements

South Washington Watershed District - Citizens Advisory Committee
We gratefully acknowledge the involvement of the following members of the South Washington Watershed Citizens Advisory Committee:

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For access to data in the Oakdale Wildlife Corridor

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Executive Summary

The SWWD Watershed Management Plan (SWWD, 1997) identified a greenway corridor encompassing the major drainage route, or *backbone of the drainage system*, for the watershed. This corridor, as originally conceived, would link Lake Elmo Regional Park with Cottage Grove Ravine Regional Park and the Mississippi River to the south. The SWWD Greenway Corridor would also provide a link to the new State Park being proposed for Grey Cloud Island, as well as Grey Cloud Dunes Scientific and Natural Area - one of the largest and best quality native prairies in the Twin Cities Area.

The goal of the SWWD Greenway Corridor is to create a multipurpose system of open space that provides a physical link to existing natural areas while providing for conveyance of storm water runoff to the Mississippi River. This linear system of open

space provides a cost-effective overland route for storm water runoff while providing for amenities important to local communities. Key functions of the SWWD Greenway Corridor include: connection of important natural areas, active and passive recreational opportunities, fish and wildlife habitat, rare species habitat, groundwater recharge, water quality protection, environmental education and erosion control.

Although "greenways" have lately been at the forefront of natural resource management initiatives, they are not new. In fact, the *linear park approach,* has been in existence in Europe, and later here in the U.S., for many years. A local example is the Minneapolis Park System, clearly one of the most defining elements in the City of Minneapolis. The SWWD Greenway Corridor borrows on many of the attractive features of existing linear

park systems, yet will be unique in that a major emphasis will be to restore/reclaim the historic prairie and oak savanna that once covered southern Washington County.

Key Recommendations

Missing Links: The SWWD Greenway Corridor Study included identification of *Missing Links* – that is, areas of the corridor where gaps in open space currently exist. Most of the *Missing Links* encompass agricultural land; however, several areas are identified that are currently undergoing development.

It is proposed that for each of the identified *Missing Links*, the following be implemented:

1. Detailed site survey of physical and biological features including soils, hydrology, geology and natural communities. Management concerns such as erosion, invasive species infestations and other relevant features should be mapped and described.

2. Meetings with corridor segment stakeholders to determine local landowner and city concerns and issues. Stakeholders will develop vision for corridor segment within framework of Greenway Corridor Plan.

3. Prepare Corridor Segment Design detailing location and specific plans for natural community restoration/reclamation, location of storm water conveyance facilities and passive/active recreational amenities.

4. Secure funding sources and leverage SWWD dollars though appropriate grant programs.

Protection Areas: The Greenway Plan identifies three key areas of ecological significance important to the Greenway, yet are in danger of loss or further degradation. The three key areas are Gables Lake East, Mississippi River Bluff and Grey Cloud Dunes Terrace. Management of these areas is largely in the hands of private property owners; therefore the recommended approach is to develop site-specific stewardship plans fashioned after the Neighborhood Wilds Program. This program works with multiple landowners to inventory natural features, develop management goals and recommend stewardship strategies.

Private/Industrial Landowners: The SWWD is in a unique position to work with private/industrial landowners including State Farm Insurance and 3M Cottage Grove. Discussions should be initiated to define common goals and define how the greenway may benefit local business.

Information and Education: An educational brochure to inform the local community about the Corridor should be developed. This brochure could also be designed to provide information on suggested design standards, establishment of native vegetation and use of urban best management practices

I. Introduction

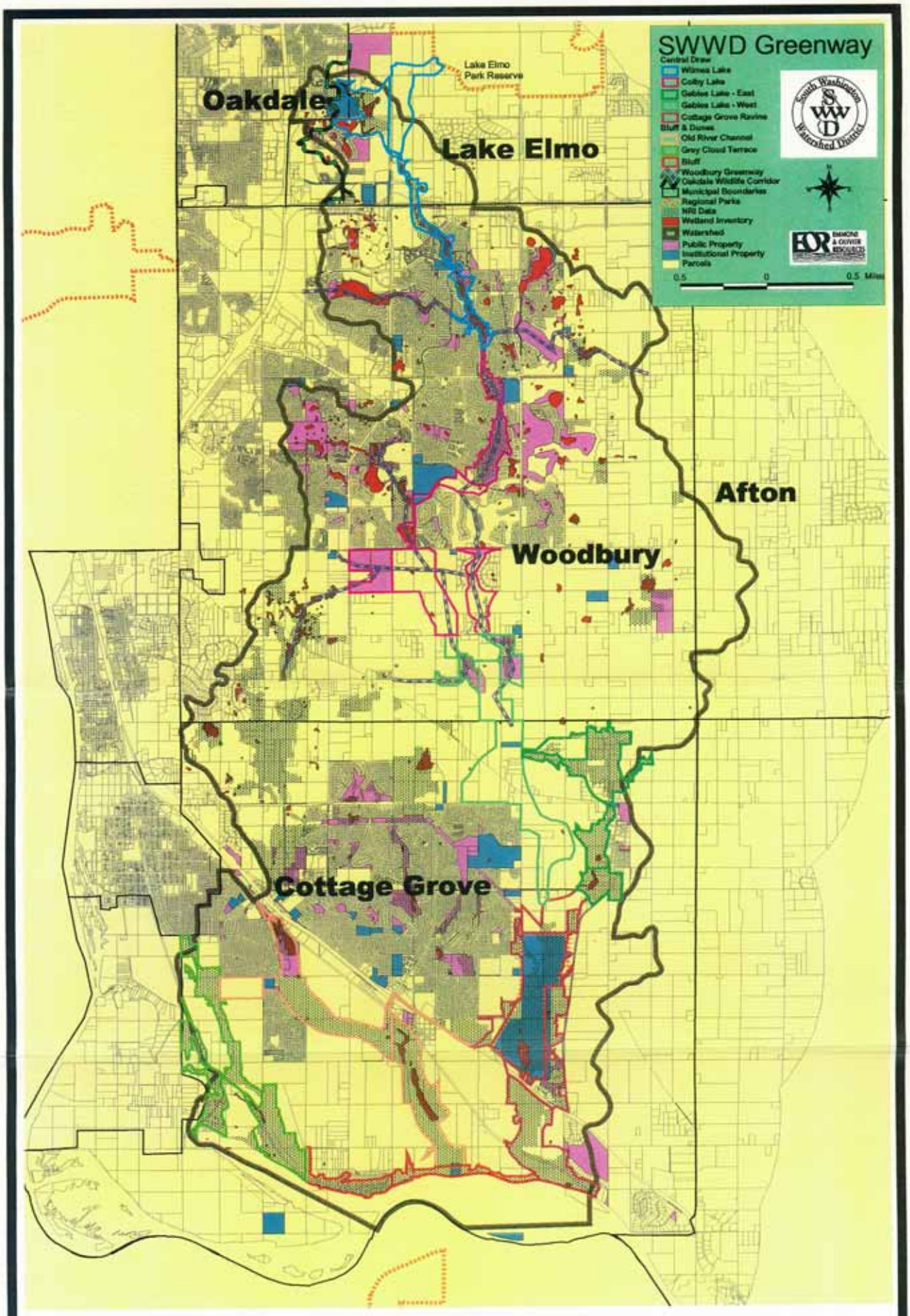
The South Washington Watershed District (SWWD) Greenway Corridor Plan serves as a guide for establishment of a greenway corridor from Lake Elmo Regional Park, south to the Mississippi River via an existing system of City/County Parks and other public or privately owned open space. At the Mississippi River, the corridor links with the Mississippi River bluffline and Grey Cloud Island. While significant portions of the corridor are already established, particularly within the City of Woodbury, much of the north and south portions are not established. One of the primary goals of this Greenway Corridor Plan; has therefore been, to identify key "missing links" that serve a critical role in connecting existing and future natural areas.

The SWWD Greenway includes several significant natural areas including: Lake Elmo Regional Park, Cottage Grove Ravine Regional Park, Grey Cloud Dunes Scientific and Natural Area, Grey Cloud Island (proposed as a future State Park), Wilmes Lake, Colby Lake, Bailey Lake, Mississippi River bluffline, 3M Property, and a large, extensive oak forest and woodland to the north of Old Cottage Grove. A greenway planning effort at the watershed level provides for a regional perspective and facilitates planning across multiple jurisdictions.

The SWWD Greenway Corridor, necessarily, provides multiple functions including connectivity between fragmented natural areas, wildlife habitat, active and passive recreational opportunities, water quality protection and stormwater conveyance. The aesthetic, cultural and historic significance of land included within the SWWD Greenway Corridor also serves to define the character of local communities spanned by the Corridor.

The SWWD *Second Generation Watershed Plan* identifies many goals consistent with the development of Greenway Corridor and suggests corridor alignments. The Cities of Oakdale, Woodbury and Cottage Grove, though their comprehensive plans and natural resource inventories, have also identified corridor alignments as well as the local values important to area residents. This Greenway Corridor Plan serves to compliment and build upon these past efforts, while providing additional detail where necessary.

The SWWD Greenway Corridor Plan identifies and prioritizes key parcels and segments within the corridor and prescribes implementation steps for use by local units of government and the development community in collaboration with the SWWD. Land protection tools including conservation easements and buffers are recommended for specific corridor segments. In other segments, partnering with private and public entities that are already effectively managing open space is proposed. A concept plan suggesting corridor design standards is proposed as a model for use by cities, developers and the SWWD. This model addresses such parameters as minimum corridor widths, natural community reclamation, and placement of recreational infrastructure and road crossings for wildlife.



SWWD Greenway Corridor- Location Map Figure I-1

II. Defining and Evaluating the Corridor

The SWWD Greenway Corridor project included extensive data gathering from many sources. Data on soils, topography, lakes, wetlands, natural communities and existing public and private open space were utilized to establish preliminary corridor boundaries, and later, to evaluate the suitability of the corridor for locally important functions. To provide a geographic framework for planning purposes, the corridor was subdivided into segments, with segments broken down based on such parameters as current/future land use, natural resource characteristics, potential management strategies and SWWD goals. Segments are shown in Figure II-1. Descriptions of the physical and biological features in each segment are provided in Section III of this report.

The SWWD CAC played a key role in evaluating information on the Corridor and defining *Local Values* important to citizens of the SWWD. *Local Values* were ranked according to priority by the CAC. While all Local Values are important, this ranking provides a priority context to guide future decision-making by the SWWD, Cities and developers. To aid in evaluating suitability of the existing/proposed corridor to providing for Local Values, *Suitability Criteria* were developed. *Suitability Criteria* include corridor attributes needed to reasonably provide for *Local Values.*

Following, is a brief discussion of the planning process used in defining and evaluating the SWWD Greenway Corridor:

A. Use of Existing Planning Studies and Data

Making logical decisions about the Greenway Corridor alignment involved gathering and evaluating many different existing data sets. The data sets were collected from municipalities, local agencies, regional agencies and some information was provided by SWWD. In order to expedite GIS (Geographic Information System) mapping electronic data sets were used. For data sets not available in electronic format, hard copies were collected, digitized and organized in the GIS. Once organized and mapped the Citizens Advisory Committee (CAC) was able to determine a logical alignment for the corridor. Special attention was given to significant natural features, public parcels and a feasible storm water alignment.

Local municipalities such as Oakdale, Woodbury, and Cottage Grove contributed many types of planning information to the project. Oakdale contributed their wildlife corridor information to the District. Maps showing Oakdale's proposed wildlife corridor were incorporated into the GIS. Woodbury and Cottage Grove have both completed Natural Resource Inventories. Those inventories provided much of the information used in determining the corridor alignment and provided valuable evaluation information for each of the natural communities found within the city limits. Other information provided by Woodbury and Cottage Grove includes, public parcels, trails, city greenways, storm sewer alignments, landuse and zoning.

Washington County also provided information to the project. The GIS parcel information was used to determine which properties were publicly held and for private parcels, the owners. Also, information from Washington County's greenway plan offered guidance to the CAC.

Information provided by Minnesota Department of Natural Resources (DNR) was also instrumental in developing the corridor alignment. The DNR's County Biological Survey (CBS) and Natural Heritage Database identified ecologically important areas within the District. Significant natural features like the Grey Cloud Dunes Scientific Natural Area as well as information on natural communities and rare plants and animals aided in determining which sites should be incorporated into the corridor.

B. Local Value Assessment

The CAC met five times over the course of the planning process to define corridor boundaries and recommend implementation steps. The CAC developed and prioritized local values for the SWWD Greenway Corridor. Local values reflect social and ecological corridor functions as well as water resources-related goals of the Watershed. Local values are taken from the SWWD Watershed Plan as well as existing planning studies and natural resource inventories of cities within the watershed. The top ten local values were then ranked on a scale from one to ten by the CAC. Each value was assigned independent of the others with ten being of significant importance and one being of little importance. The survey results provide guidance in the development of a corridor implementation plan. Table II-1 summarizes local values, their regional need or significance and results of prioritization.

The survey results show that local values important to maintaining ecological functions such as connectivity, wildlife habitat and to a lesser degree, rare features, are considered very important. Not surprisingly, water quality and to a lesser degree, water quantity are considered important. Non-natural resource-based values, such as cultural resources and active recreation, were deemed to be low in importance compared to other identified values.

C. Corridor Suitability Evaluation

As a general rule, the boundaries of the SWWD Corridor reflect existing physical and biological features such as lakes, wetlands, forests, steep slopes and other natural features. Land use zoning designations, such as floodplain, parks and trails are often correlated with these features and also define the corridor boundaries. Establishing how well these existing boundaries function in providing for local values and how additions to the corridor should be evaluated are determined by the corridor suitability criteria. Corridor suitability criteria were defined based on review of literature for establishment of buffers and protection of riparian areas. Additional consideration was given to ecological requirements of natural communities and rare plants and animals known to occur in the corridor.

Table II-1: Summary of Local Values, Their Significance and Priority

Local Value	Regional Need or Significance	Numeric Mean Score	Priority Ranking
Storm water Quantity[3]	*Regional flooding potential, particularly within land-locked areas of watershed require flood retention, infiltration and conveyance facilities with outlet to Mississippi River.*	7.5	5
Storm water Quality[3]	*SWWD compliance with MPCA Total Maximum Daily Loading (TMDL) criteria for NPDES II permits on Mississippi River (pool 2) and pretreatment for water quality protection of watershed lakes and wetlands.*	8.6	1
Natural Communities[1 2 3]	*Natural Communities (i.e., forests, wetland and prairie) define urban/nonurban landscape along corridor-serve as amenity to local communities.*	7.6	4
Rare Features[1 2 3]	*Rare natural communities, plants and animals define character of, and serve as barometers to overall ecological condition of watershed.*	7.3	6
Connectivity[123]	*Connectivity provides linkage to existing/proposed open space areas, thus enhancing other values including wildlife habitat, trails systems and stormwater conveyance.*	8.1	2
Wildlife Corridors[2 3]	*Greenways serve as corridors for both generalist (i.e., deer, turkey, raccoon) and specialist (i.e., loggerhead shrike, osprey, Blanding's turtle) Wildlife diversity serves as barometer to ecological condition of watershed.* .	7.9	3
Cultural Significance[1]	*Prehistoric and Historic features define our heritage and serve as visual landmarks to local communities.*	4.3	10
Recreation[1 2 3] *(Active)*	*Local communities desire active recreational activities such as biking, inline skating and organized sports.*	4.9	9
Recreation[1 2 3] *(Passive)*	*Local communities desire passive recreational activates such as hiking and bird watching.*	7.1	7
Educational Opportunities[2 3]	*Schools and other public institutions benefit from close proximity to the SWWD Corridor though opportunities for environmental education.*	5.4	8

Public Values: Tangible or perceived social benefits
Regional Need or Significance: The regional context – how Public Values apply specifically to SWWD
Priority: Ranking of Public Value importance within SWWD on scale from one to ten. ***How important are different Public Values in developing the SWWD Corridor?***

Level of Importance	Numerical Score
Low Importance	1
	2
	3
	4
Moderate Importance	5
	6
	7
	8
	9
Very Important	10

Source of Local Value

[1] Cottage Grove Natural Resource Inventory
[2] Woodbury Natural Resource Inventory
[3] SWWD Plan

Priority ranking was determined by averaging numerical scores. Number 1 priority was given to the Local Priority receiving the highest numeric score.

Table II-2: Corridor Suitability Criteria

Assessment Values for Landscape Units

Function	Site Suitability Criteria
Stormwater Quality	Topographic Position in Watershed
	Presence and Size of Existing Channels
	Drainage Area
	Sensitivity to Erosion
	Location and Sensitivity of Natural Resources
	Potential Impacts to Private/Public Property
Stormwater Quality	Quality/Sensitivity of Existing Lakes & Wetlands
	Topographic Position in Watershed
	Wet Storage Volume Potential
	Proximity to Developed Areas
Stormwater Infiltration/Groundwater Recharge	Potential Storage Capacity of Depressions
	Permeability/Hydraulic Conductivity
	Depth to Groundwater Table
	Discharge Potential Down gradient of Site
	Topographic Position in Watershed
	Groundwater Appropriations Down gradient of Site
Wildlife Habitat	Width of Corridor
	Linkage to Other Large Areas
	Diversity of Natural Communities
	Quality of Natural Communities
	Unique or Rare Habitat
	Degree of Fragmentation
	Isolation from Disturbance
Rare Features	Documented Rare Features
	Potential for Rare Features
	Diversity of Natural Communities
	Quality of Natural Communities
	Proximity to Unique/Unusual Features
	Proximity to Mississippi River Valley
	Ambient Noise
Recreation	Proximity to Public, Accessibility
	Connectivity to Existing Trail System
	Aesthetic Quality
	Soil Type and Condition
	Slope and Aspect
	Existing/Proposed Land Use

D. Landscape Units

To aid in describing corridor features and conducting planning activities, the corridor is subdivided into Landscape Units. Landscape Units are subdivisions within corridor segments and generally ranging from about one hundred to several hundred acres in size. Boundaries between Landscape Units are based on geologic features, changes in plant communities, hydrologic boundaries, current/future land use, land ownership and other distinguishing features. Divisions of landscape units are also defined based on similar benefits, values or opportunities provided by a given area. Landscape units within corridor segments are shown

E. Missing Links

While much of the Corridor is already established by local communities or identified under existing local plans as open space, several significant gaps were identified. Missing Links are described with respect to location and existing condition. Missing Links are shown in Figure II-2. Table II-3 summarizes the location and key features/issues along with the level of priority (from 1, highest to 5, lowest).

Table II-3 Summary of Missing Links in Corridor

Missing Link	Location	Comments	Priority
A	Lake Elmo Regional Park to State Farm Office Bldg.	Requires road crossing at CSAH 10 and Interstate 94. Interstate 94 poses significant problem for wildlife crossing. State Farm Insurance headquarters has large prairie planting along south side of Interstate 94.	1
B	Colby Lake to Bailey Lake	Natural flowage between two lakes within existing golf course. Woodbury School property to west offers possible route.	5
C	CD-P85 to Cottage Grove Ravine Park	SWWD currently negotiating with property owners to obtain stormwater infiltration and conveyance facilities. Large area along slopes slated for reclamation to prairie and oak savanna. City of Cottage Grove in process of preparing Master Plan for portions of this area. Road crossings required at Military Road and CSAH 19.	4
D	SW Corner Cottage Grove Ravine Park to old river channel via Langdon Pond	Road crossings at CSAH 19 and Highway 61. Highway 61, in particular, poses concerns for wildlife crossing. Langdon Pond area south of Hwy 61 may be difficult to connect to due to industrial park development. Bluffline above Hwy 61 (near drive-in theater), contains degraded sand gravel prairie with restoration potential.	2
E	Grey Cloud terrace N. of Mississippi Dunes SNA.	Extension of same terrace upon which Grey Cloud Dunes SNA occurs. While most prairies degraded, offers excellent opportunity to expand and link into one of the largest and best quality prairies in the Twin Cities. Most of this ridge, steep and unbuildable with excessively well-drained soils.	3

F. Protection Areas

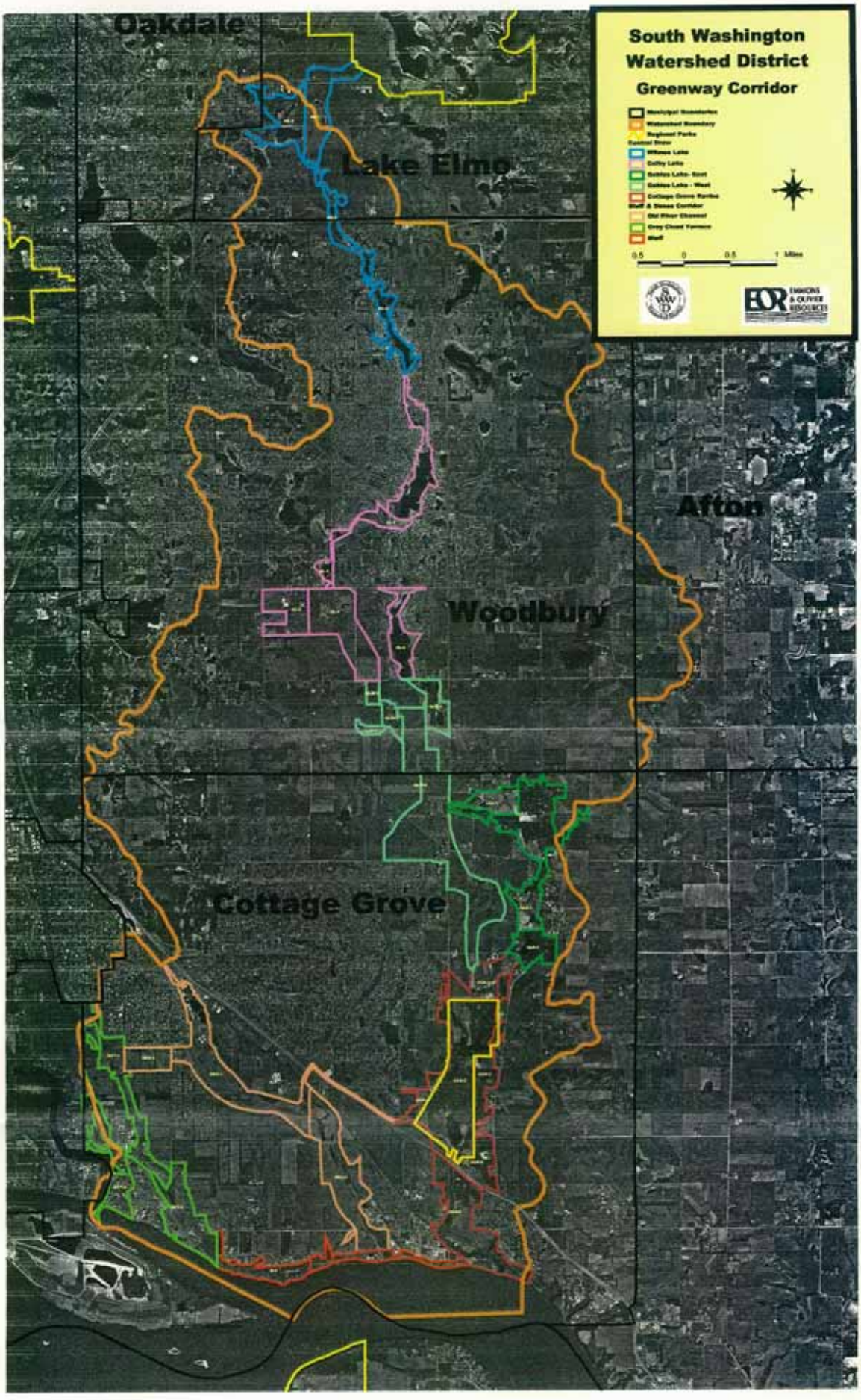
Several natural areas within the proposed corridor are currently unprotected, yet are either worthy of protection or provide excellent opportunities for reclamation/restoration. Protection areas were identified based on having the following characteristics:

- Significant natural communities
- Documented threatened and endangered species (or high potential for occurrence)
- High quality wildlife habitat
- Provide a critical link to other nearby areas of ecological significance
- Not currently protected or identified as open space.

Table II-4 summarizes the location of the three major protection areas; the forest area between Gables Lake and Cottage Grove Ravine Regional Park, the Mississippi River Bluff, and the ridgeline to the northwest of Grey Cloud Dunes SNA (see Figure II-2). The significance of these three areas is described in Section III of this report. Recommendations for these areas are provided in Section IV of this report.

Table II-4 Summary of Protection Areas in Corridor

Protection Area	Comments
Gables Lake to Cottage Grove Ravine Regional Park. Northeast corner of Cottage Grove	This area contains remnant oak savanna with good restoration potential. Other community types such as forest, prairie and wetland are also found. Most of the land is privately held in small parcels. Potential for Kitten-tails is likely within this area.
Mississippi River Bluff	This area is heavily wooded and contains many steep slopes. MCBS has identified stands of Maple-Basswood Forest, Oak Openings, cliff communities, Floodplain Forest and prairies. Most of the land is held by 3M and the remainder by small private parties.
Grey Cloud Terrace	This area is in close proximity to the Grey Cloud Dunes SNA. Reclamation of many of the brushy old fields could provide additional habitat for the many state listed species, which are known to occur in the area.



SWWD Greenway Corridor- Segment Location Figure II-1

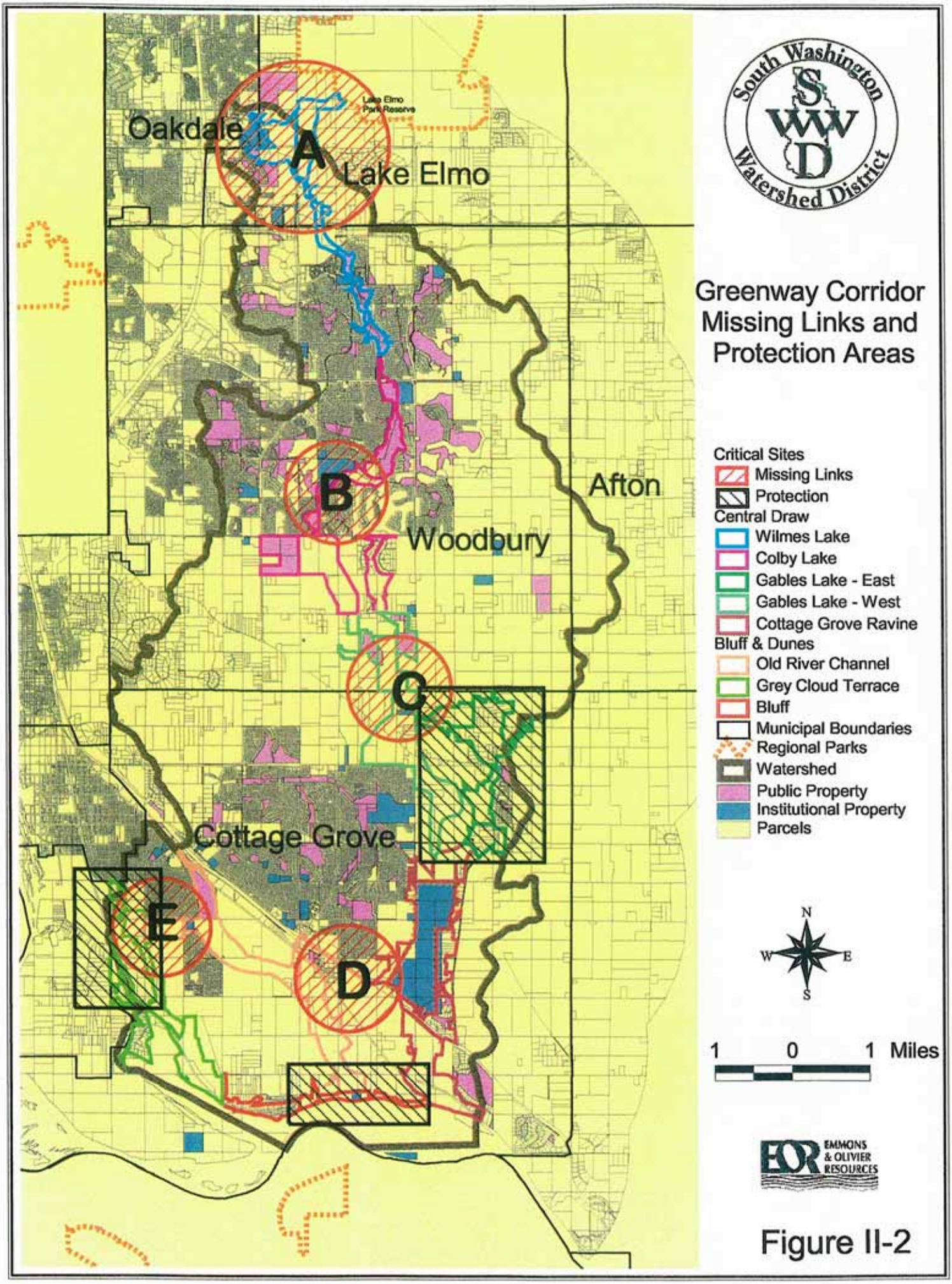

Oakdale
Lake Elmo Park Reserve
A
Lake Elmo
B
Afton
Woodbury
C
Cottage Grove
E
D
South Washington Watershed District
SWWD
Greenway Corridor Missing Links and Protection Areas
Critical Sites
Missing Links
Protection
Central Draw
Wilmes Lake
Colby Lake
Gables Lake - East
Gables Lake - West
Cottage Grove Ravine
Bluff & Dunes
Old River Channel
Grey Cloud Terrace
Bluff
Municipal Boundaries
Regional Parks
Watershed
Public Property
Institutional Property
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Figure II-2

III. Corridor Segment Description

The proposed corridor runs from the Lake Elmo Park Reserve south to the Cottage Grove Ravine Regional Park and the Mississippi River, then extends west along the Mississippi River bluffs to Grey Cloud Island. The terrain in this region has been heavily impacted by glacial activity. The topography is characterized by gently rolling hills and a sandy-gravelly soil, the result of glacial outwash deposited during the last glaciation. Scattered lakes and wetlands formed where ice blocks left by the retreating glaciers were buried under layers of this outwash and subsequently melted. The corridor itself is defined by a network of intermittent streams and lakes running through a shallow, north-south trending valley in the center of the watershed district. Historically, the valley was created as glacial meltwater flowing beneath the ice lobe excavated a channel through the deposits of glacial till. Today, the valley remains shallow and poorly defined in its northern stretches, and becomes more pronounced further south. It is most strongly defined within the Cottage Grove Ravine, a moderately steep, wooded ravine system near the southern end of the project. The corridor has been divided into segments, as follows:

A. Wilmes Lake Segment

1. General Description

This is the most northern portion of the corridor, and encompasses the area from the Lake Elmo Park Reserve to the middle of Woodbury. The valley is poorly defined here; north of I-94 it is apparent only as a series of small lakes, wetlands, and connecting streams in a landscape of small rolling hills. South of I-94 a shallow valley is apparent, with slight hills on either side of the lake/stream corridor. Land use in this section ranges from rural to urban, with the northern areas more rural in character. A few active farms remain; however, most of the fields now lay fallow or are converting to residential subdivisions or small commercial centers. There are several large housing developments along the corridor, within the City of Woodbury.

Boundaries for this greenway segment were established by evaluating a variety of different issues. In the northern portion of the segment, boundaries were established by connecting natural features through undeveloped areas to Lake Elmo Park. North of I-94 a linear sequence of wetlands exists, forming the central part of the corridor up to Armstrong Lake. From Armstrong Lake the corridor angles northeast to connect to the Park. This connection is made across large lots used for agriculture production. Immediately south of I-

94 the corridor follows a DNR protected waterway containing a series of wetlands. For this greenway section, the outer boundary was determined by the limits of remaining natural features and apparent wetland soils. South of Hudson Road, the corridor is fully established. Public property including large wetlands and Wilmes Lake bordered by residential homes, define the limits of the greenway.

I-94 significantly breaks the continuity of this corridor. The storm water pipe does not provide passage for animals because of its small diameter and length. Chain link fences along the interstate impede terrestrial wildlife migration. Construction of a wildlife bridge or installation of a large box culvert is the only way to restore ecological integrity to this section of the greenway.

2. Description of Landscape Units

For a summary of Natural Community types and locations, see AppendixA .

WL-1: This northern-most section of the corridor forms the connection between the Lake Elmo Regional Reserve and the rest of the corridor, in the South Washington Watershed District boundaries. Natural communities in this area include a small woodlot on the north side of 15th street and 1 mile east of Co. Road 13. This site is dominated by 8 – 12" dbh boxelder, with numerous 3-6" boxelder in the subcanopy. It is fairly moist, and some pole-sized silver maple are established around the edge of the woods and in canopy gaps. European buckthorn is common in the shrub layer. Throughout, the ground layer is a relatively uniform mix of burdock, Enchanter's nightshade, poison ivy, and yellow avens. Another small woodlot, at the corner of 15th and Co. Road 13, has a canopy of widely spaced, open-grown bur, white, and pin oak (average dbh 20"), with a dense subcanopy of boxelder and occasional Siberian elm. European buckthorn is abundant in the shrub layer.

Other communities in this segment include several small- to medium-sized wetlands in agricultural fields. These are mostly seasonally flooded shallow emergent marshes, with narrow-leaved cattail around areas of open water and extremely dense reed canary grass. Where water levels are too low to support cattail, reed canary grass dominates the entire site.

WL-2: This unit encompasses the area around and west of Armstrong Lake, the most prominent feature within the unit. Land cover is a mix of scattered wetlands, woodlots, and fields. There is small, disturbed oak woodland at the northeastern end of the lake, with a low, patchy canopy of 16" – 18"dbh red oak and white oak, with significant amounts of boxelder and American elm, and moderate levels of buckthorn. Other wooded areas include a boxelder woodlot and a black locust woodlot, and brushy patches of cottonwood along the stream corridor. There is a small, semi-permanently flooded marsh and wet meadow near the northern end of the site. This is dominated by narrow-leaved cattail in marshy areas, and extensive patches of reed canary grass where the soil is slightly drier. Similarly, the stream corridor itself is dominated by reed canary grass.

WL-3: Landscape Unit 3 follows the stream corridor southeast, under I-94 and into the City of Woodbury. The upper portion of the segment flows through a golf course and an agricultural field, where it is narrowly bordered by some tall cottonwood. There is a small grove of pin oak along the corridor, just north of the frontage road, and a disturbed woodlot of elm, boxelder, green ash, and cottonwood immediately south of the frontage road. A small, excavated pond in the vicinity has a narrow band of red oak around the perimeter. After crossing under I-94, the corridor broadens into a broad, shallow wet meadow dominated by reed canary grass.

WL-4: This Landscape unit is dominated by Wilmes Lake and its associated natural communities. The northern and southern ends of the lake grade into shallow emergent marsh, with dense stands of hybrid cattail and occasional wooly bulrush and swamp milkweed. Most of the shoreline around the northern section of the lake and the areas immediately upslope from the marshes are wet meadow, dominated by reed canary grass.

A narrow wooded corridor connects the upper and lower portions of the lake. On west-facing slopes, this corridor is dominated by young oak woodland, with numerous young red oak-pin oak hybrids and a patchy canopy of larger hybrid oak. European buckthorn forms a dense shrub layer. In the lowlands along the stream channel, a narrow band of silver maple floodplain forest occurs. Some of the trees along the corridor are massive, and the diameter of one silver maple was estimated at nearly 6 feet. There is heavy sand deposition in the stream channel.

The southern section of Wilmes Lake is more wooded, with a disturbed woodlot of American elm, boxelder, and green ash on the slopes above the western shore. Dense layers of European buckthorn dominate the shrub layer.

B. Colby Lake Segment

1. General Description

The Colby Lake segment is almost entirely within the City of Woodbury. It ranges from the south end of Wilmes Lake to the south end of Bailey Lake. Within this stretch, the stream continues through a shallow, poorly defined valley and the lakes become significantly larger. Wooded areas persist primarily along portions of the lake shore and along scattered steep ridges. Housing and commercial developments are common throughout the northern stretches of the area. The southern areas remain less developed.

The Colby Lake region of the corridor contains large depressions as well as a large plateau to the northwest of Bailey Lake. This region generally consists of outwash deposits overlain by sandy soils. There are very few till deposits along this region.

Steep slopes commonly surround existing water bodies, with the exception of Colby Lake.

From the south end of Wilmes Lake to the south end of Colby Lake, the greenway corridor is established. Public property makes up nearly all of the area and a trail system runs the entire length. From Lake Drive south the corridor is not established. Storm water flows straight south through the golf course but in order to develop a functional greenway the corridor will need to be realigned around the golf course.

At this time the most logical alignment at the south end of Colby Lake is to move the corridor west to include the school property. From the school property the corridor may then continue south through the large Bailey Ridge wetland to Bailey Road. This is a marginal link, with minimal wildlife passage potential.

From Bailey Road, south, the corridor has good potential. The corridor was widened to incorporate some City of Woodbury property, including the large sports facility. Wetlands and historic drainage routes were then followed to Dale Road. Bailey Lake is included in this segment because of it local wildlife habitat benefits and storm water conveyance, although linking Bailey Lake with the remainder of the corridor is problematic. Bailey Lake's lakeshore is fully developed and privately held. Therefore, creating an established trail system or providing a wildlife link along the contiguous corridor is unlikely.

2. Description of Landscape Units

For a summary of Natural Community types and locations, see Appendix A .

CL-1: This northern-most unit of the Colby Lake segment begins at the south end of Wilmes Lake and ends at the south end of Colby Lake, and includes Colby Lake Park. A disturbed woodlot of box elder and elm, with infrequent pin oak, dominates the steep slopes above and to the west of the stream corridor. Within low areas, along the stream corridor, vegetation is similar. Box elder and American elm are common, with some green ash. Reed canary grass forms a dense ground-layer cover along the stream banks. Several shallow wetlands occur within this segment. These generally have low diversity, and range from shallow emergent marshes dominated by narrow-leaved or hybrid cattail, or reed-canary grass dominated wet meadow. Other vegetation in this unit includes areas of old field vegetation along the trails, large mowed tracts of turf grass around baseball fields and other public use areas, and a small plantation of red pine.

CL-2: This landscape unit runs from the south end of Colby Lake west to Pioneer Drive. There are no natural communities in this area. The landscape includes mowed turf grass around baseball fields and the golf course, a stormwater pond, and some old field vegetation on portions of the school property.

CL-3: This unit includes the large Bailey Ridge wetland, a seasonally flooded basin that experiences highly fluctuating water levels. As a result of this fluctuation, very little vegetation is currently established on site.

CL-4: This entire site is a gravel mine with some portions of the site slowly reverting to early-successional grasses and forbs and other portions of the site actively being mined. It is dominated by old fields with smooth brome and Kentucky bluegrass and agricultural fields, with occasional small, seasonally flooded cattail marshes.

CL-5: This unit includes the City of Woodbury property south of Bailey road. A mix of agricultural fields and old-field vegetation and a large sports facility dominates the landcover. Scattered wetlands include small, seasonally flooded cattail marshes dominated by narrow-leaved cattail, often with abundant reed canary grass around the perimeter. Common wetland forbs including smartweed, pinkweed, and swamp milkweed are occasionally present.

CL-6: This portion of the Colby Lake segment includes Bailey Lake and associated upland areas. These communities are listed in the Woodbury Natural Resource Inventory as Communities 21A through 21D. The most significant natural resource features include Community 21A (Bailey Lake), an extensive open water/emergent marsh wetland created in part, by the placement of an outlet weir structure on the south end of what was once an emergent marsh complex. A steep, west-facing ridge spans the entire east side of the Bailey Lake. The most significant natural community along this ridge includes a moderate quality dry oak forest.

C. Gables Lake East & West Segments

1. General Description

This segment extends from Dale Road to an area north of the Cottage Grove Ravine Park and straddles the boundary between the townships of Woodbury and Cottage Grove. The terrain is similar to the more northern segments, with rolling hills, shallow valleys and scattered lakes and wetlands through the corridor. In this segment, land uses range from large-lot rural development to agricultural.

The Gables Lake segment of the corridor is dominated by depressions formed by ice blocks during the retreat of the glacier. Ice blocks broken off of the glaciers melted to form many of the land-locked depressions located in this landscape. Beneath these depressions are sand and gravel outwash deposits. These deposits have the potential to infiltrate significant amounts of water. Bedrock is found at or near the surface south of the Woodbury/Cottage Grove boundary in the east.

The Gables Lake segment can be divided into two subsegments; East and West. Gables lake east links Dale Road to the Cottage Grove Ravine Segment. Gables lake west

provides an additional route following the historic glacial valley from the CD-P85 basin to the north end of Cottage Grove Ravine Park.

For the most part Gables lake west is defined along a feasible storm water conveyance corridor. Existing City of Woodbury property and storm water infrastructure is located along the northern portions of this segment. As the corridor progresses southward the boundary is defined by undeveloped areas, soils with high infiltration capacity and topography. Aside from one small wetland, very few natural features exist within Gables Lake West.

Gables Lake East on the other hand is clearly defined by natural features. Agricultural fields almost entirely encompass this large contiguous area. The only exception being the short portion along its east perimeter which makes up Old Cottage Grove. Wetlands, Gables Lake, woodlands, savannas and large lot development can be found within this old glacial valley. Boundaries for Gables Lake East were taken directly from the communities delineated in the Cottage Grove Natural Resource Inventory.

2. Description of Landscape Units

Gables Lake – East

GL-E.1: This segment encompasses an area of pasture and oak savanna surrounding Gables Lake. During the Cottage Grove Natural Resources Inventory (1998), this area was heavily grazed and in generally poor condition. As general rule, the entire site was dominated by nonnative grasses such as Kentucky bluegrass and smooth brome. Gables Lake is classified as a shallow, open water marsh with a narrow, emergent marsh fringe. With proper management following cessation of grazing, this wetland has the potential for recovery. The oak savanna (community 1H), although degraded, contains large-diameter bur oak averaging 20-inches in diameter. This community provides a good opportunity for oak savanna restoration.

GL-E.2: This segment includes approximately 250 acres of mostly moderate quality oak forest and woodland. The most significant natural resource feature of this site is a steep, north-facing slope of mesic oak forest with several areas of exceptionally large basswood trees. Diameters of the basswood trees range from 20 to over 25 inches. Most of the mesic oak forest in this area contain large, bur oak trees averaging about 200 years of age. Younger, and much smaller mesic hardwood trees, have over the years, filled in between the large bur oak trees due to a lack of fires. Through this process, the historic oak savanna has gradually succeeded to the oak forest that we see today. This segment potentially provides habitat for rare plants and animals and is; therefore an area worthy of active stewardship.

GL-E.3: Natural resources in this segment include low to moderate quality mesic oak forest, maple-basswood forest, oak savanna, cattail marsh, wet meadow and deep-open water wetland (Cottage Grove Natural Resource Inventory Site 11A-11F). The most

significant natural feature of this segment; however, is the presence of Kittentails (*Bessya bullii*), a Minnesota State Endangered species. GL-E.3 provides excellent opportunities for natural community restoration of wetland, savanna and prairie communities.

GL-E.4: This segment encompasses an approximately seven-acre lake, which like many lakes in the SWWD, has risen substantially in recent years. The lake is bordered by a fringe of dead snags, the result of trees flooded out from the high water levels. Both sides of the lake are bordered by a low quality mesic oak forest, with small pockets of lowland hardwood forest in some of the lower-lying areas. Natural communities for GL-E.4 are described under communities 11G-11I of the Cottage Grove Natural Resource Inventory.

Gables Lake – West

GL-W.1: This segment contains row crop agricultural land

GL-W.2: This segment includes South Bailey Lake and includes Woodbury Natural Resource Inventory communities 27A though 27C. The segment is dominated by a stormwater pond (South Bailey Lake) with a narrow fringe of emergent marsh wetland vegetation. South Bailey Lake flows sourthward through a small area of dry oak forest and then a young conifer plantation.

GL-W.3*:* Along the west side of CD-P85, an old conifer plantation spans the entire west side of the site.

GL-W.4: Natural resources in this segment include a moderate quality mesic oak and maple-basswood forest delineated as communities 31A and 31B, respectively, in the Woodbury Natural Resource Inventory. Although this forest area encompasses only about 22 acres, it is important in that it is one of the few moderate quality forest areas in this portion of the corridor.

GL-W.5: This large landscape unit is primarily being used for agricultural purposes. Some portions are used for row crop production and others for hay. Along some of the steeper side slopes old field vegetation has established.

D. Cottage Grove Ravine

1. General Description

The Cottage Grove Ravine Regional Park defines this segment of the Greenway Corridor, which terminates south of the park, in the Mississippi River. The northern portion, in the regional park, includes a moderately steep, stream dissected wooded ravine system. From here, the corridor channels through the historic floodplain and riverbed of the

Mississippi, before cutting through the bluffs around the Mississippi and entering the river.

The dominant topographic features of the Cottage Grove Ravine include large depressions (ice-block) that form an overflow route to the Mississippi River and river terraces. These depressions have steep slopes and few wetlands. The underlying deposits are generally outwash. The river terraces are generally flat and were formed during the melting of the glaciers. These terraces are generally sand and gravel deposits over bedrock. The bedrock is Jordan sandstone, which is very permeable and close to the surface.

For the most part the boundaries of this segment were determined by the limits of remaining natural features. Cottage Grove Ravine Regional Park makes up the majority of the segment north of Highway 61 and 3M owns most of the property south of the highway down to the Mississippi. Steep slopes border the segment from north to south. The glacial valley was historically used for pasturing livestock but because of the steep slopes other types of agricultural practices did not take place within the ravine. Although the entire ravine contains a DNR protected waterway, only south of the lake is there a discernable stream channel.

Highway 61 is a significant barrier to the ecological function of the entire corridor. The culvert under the highway is too small to function as a wildlife passage and the traffic is a hazard for all terrestrial animals attempting to cross it. In order to improve the biological integrity of the entire corridor, some type of wildlife bridge would need to be constructed.

2. Description of Landscape Units

CGR-1: These sloping fields outside of the park are dominated by old field and agricultural vegetation.

CGR-2: Cottage Grove Regional Park Site:
The steep, sandy slopes and the bottomlands of the Cottage Grove Regional Park support one of the largest and best quality woodlands in southern Washington County (Cottage Grove Natural Resources Inventory, 1997), and include a number of good quality wetland and prairie communities as well.

Overgrown oak woodland and dry oak forest dominate the slopes and ravine bottom within the Park. The best portions are in the southern half to two-thirds of the park, in an area mapped by the DNR on the Natural Communities and Rare Species Map of Washington County. Here, a relatively open oak woodland and dry oak forest persists. The canopy is dominated by a patchy layer of large, spreading bur oak, with diameters between 22" and 30", depending on location within the park. Interspersed with these are a number of younger red oak-pin oak hybrids, dbh 18 – 20", and 10 – 12" dbh black cherry and quaking aspen. A number of mesic forest species are established in the understory, including green ash, American elm, and hackberry, in addition to saplings of

the canopy species. The shrub layer is variable, with locally abundant prickly ash and buckthorn. Some American hazel persists in more open areas, with occasional chokecherry and gray dogwood. The ground layer generally includes bur-fruited species such as sweet cicely, enchanter's nightshade, and cleavers, as well as the forest associates false lily of the valley and rue anemone. A steep ridge on the west side of the Ravine Lake supports a large population of kitten-tails, a plant listed as Threatened in the State of Minnesota.

Sandy ridges and south facing slopes within the park frequently support prairie openings; the better quality sites occur on the slopes north and west of the Ravine Lake, and are included on the Natural Communities and Rare Species Map of Washington County. Because the soils are so well-drained, vegetation at these sites is often sparse. Typical species, depending on the site, include old field sedge, hairy grama grass, porcupine grass, and fall witch grass, with occasional patches of little bluestem. Forbs include some somewhat conservative species in the better-quality sites, such as spiderwort, northern rock cress (which has not previously been noted for Washington County), silky prairie clover and prairie penstemon, as well as more common species such as bird's foot violet , pussy toes, prairie alumroot, prairie bush clover and prairie larkspur. Spotted knapweed and Canada bluegrass have invaded many of these locations.

Along the ravine bottom, the oak woodland develops a more mesic character and is somewhat lower in quality. Here, the canopy is still dominated by large bur oak, but overall species diversity is much lower than at other sites within the park. European buckthorn forms a nearly continuous shrub layer.

At the south end of the park, small wetlands and the Ravine Lake have developed on layers of impermeable soil and/or where groundwater discharge maintains continuously wet conditions. The lake is relatively cold and clear, and contains a variety of aquatic plant species, including flatstem pondweed, leafy pondweed and Sago pondweed, a calcareous associate, as well as two species of duckweed and water meal.

The northern perimeter of the lake includes a narrow fringe of emergent marsh, dominated by cattail, and a degraded rich fen. This rich fen habitat occurs on nearly level terrain, where areas of cold groundwater discharge maintain continuously wet to saturated conditions. Vegetation at the site varies, with some patches of established vegetation and other areas dominated by seedlings, primarily beggars-ticks, smartweeds, and a grass, too immature to characterize at the time of the survey. Much of the area has been disturbed, and there are some dense patches of reed canary grass on site, especially along the eastern edge. The site also contains some common wetland sedges including *Carex stipata,* and *Carex scoparia,* and the common wetland forbs marsh milkweed, boneset, blue vervain, and American water horehound. There are also patches of manna grass, wooly bulrush, rice cut-grass, and *Carex rostrata,* a characteristic species of rich fen communities.

At the north end of the park, past land-use impacts are more apparent. Cover here includes a 38 year old conifer plantation with a mix of red pine, white pine, and spruce, old fields, heavily grazed lowland hardwood forest, and oak woodland and oak forest with various intensities of grazing history. Some opportunistic prairie species persist in these areas.

CGR-3: These Wooded and old field communities are similar to the ones in the adjacent park. The major difference between the two communities is the ownership. The communities in the park are preserved in public ownership.

CGR-4: Within this landscape unit, the Cottage Grove Natural Resource Inventory and the Minnesota County Biological Survey have identified an area containing natural features. Although somewhat degraded a sand-gravel prairie exists along the southern portion of this unit.

CGR-5: This Landscape unit contains oak woodlands similar to that in the park. The eastern boundary of the unit has been somewhat developed to large lot residential. The southern end of the unit contains a historical farmstead. This farm, at one time utilized much of the current park and surrounding areas for livestock grazing and agricultural production.

CGR-6: This entire segment is described in the Cottage Grove Natural Resource Inventory as site 25. This segment contains an exceptional diversity of good quality natural communities including dry oak forest, oak woodland, dry oak savanna, lowland hardwood forest, bedrock bluff prairie and open water/emergent marsh wetland. The DNR Natural Heritage Program lists of rare features include: dry oak savanna, dry prairie (bedrock bluff subtype), fox snake (*Elaphe vulpina)* – Official Status Threatened, illinois tick-trefoil *(Desmodium illinoense)* – Official Status Threatened, longbearded hawkweed *(Hieracium longipillum).* This segment also contains an ephemeral stream which outlets Cottage Grove Ravine Park Lake, flowing through this segment and into the Mississippi River. During the Cottage Grove Natural Resource Inventory, wildlife use of this segment was very high.

E. Mississippi River Bluffs

1. General Description

The bluff segment lies between the terminus of Cottage Grove Ravine west along the Mississippi River to the east border of the former Ashland oil property which is now a DNR Scientific and Natural Area. The bluff region has a concentration of high quality natural communities. The Minnesota County Biological Survey has identified stands of Maple-Basswood Forest, Oak Openings, cliff communities, Floodplain Forest, and prairies in this segment.

The Mississippi River forms the south boundary of this segment. The segment's north boundary, owned by 3M, consists of industrial uses and old field which is reserved for potential industrial development. The easterly half is owned by 3M and the westerly section of the Bluff segment is a small residential community. Some homes are built along the river abutting the waterfront and some are perched above the cliffs. The area is comprised of heavily wooded steep slopes.

2. Description of Landscape Units

B-1: Segment B.1 includes the sourthern-most portion of Site 25 of the Cottage Grove Natural Resource Inventory. This segment includes the blufflands along the Mississippi River with good quality examples of oak woodland, dry oak forest, open water marsh and dry praire (bedrock bluff subtype). This segment has among the highest ecological values of any site in the SWWD Corridor. Rare features documented include: fox snake (*Elaphe vulpina)* – Official Status Threatened, illinois tick-trefoil *(Desmodium illinoense)* – Official Status Threatened, longbearded hawkweed *(Hieracium longipillum)*. In addtion, two high quality dry praires (bedrock bluff subtype) are mapped by the DNR. This segment is particularly isolated due to its location between the Mississipi River bluff and two ravine systems.

B-2: Site 22 of the Cottage Grove Natural Resource Inventory represents Segment B.2. This segment includes low to moderate quality lowland hardwood forest, oak forest and black ash seepage swamp. An area of higher quality basswood forest (mesic oak variety) occurs within a deep ravine along the east side of the site (22E). Since much of this segment abuts a residential development, impacts from fragmentation and introducation of invasive species is generally higher than elsewhere along the bluff. This segment also contains a large spring with a black ash seepage swamp – an uncommon natural community in the SWWD.

F. Old River Channel

1. General Description

This segment as its name implies is an old river channel formed by Glacial River Warren. Topography of the entire segment is level to gently sloping. The upper part of the corridor consists of old field grasses and excessively drained soils. The two wetland complexes located along the lower portion of the segment are bordered by old field communities. The grassy uplands within the lower portion of the segment are known to support nesting pairs of loggerhead shrikes, a state threatened bird.

The Greenway corridor boundary was primarily determined using topography. The old channel forms an easily discernable geologic feature. A narrow connection is shown to the Cottage Grove Ravine Segment. This connection would function as a recreational trail but would not operate as a wildlife corridor. Wildlife could possibly use the bluff line to get to the Cottage Grove Ravine Park but would need to cross 3M property and US Highway 61.

The City of Cottage Grove is constructing a storm water flume in the north half of the segment. The flume will transport storm water from the West Draw, through the wetlands and to the Mississippi River.

2. Description of Landscape Units

ORC-1: This segment is described in the Cottage Grove Natural Resource Inventory as site 23A. The entire segment consists of old field vegetation dominated by smooth brome, Kentucky bluegrass, perennial rye and timothy. A few scattered pockets of prairie grasses and forbs occur throughout the site with species such as Indian grass, whorled milkweed and blue vervain. Spotted knapweed, and invasive species, also occurs in this segment.

ORC-2: This segment is identified as sites 23A, 23B and 24A through 24E in the Cottage Grove Natural Resources Inventory. This segment contains good quality mixed emergent marsh, cattail marsh, mesic oak forest, oak woodland and dry prairie. The north portion of the segment contains old field vegetation similar to that found in 23A, but with a higher frequency of prairie patches occurring. The south portion of the segment includes high quality mesic oak forest, dry prairie (bedrock bluff subtype) and oak woodland. The Minnesota DNR Natural Heritage Program lists one rare feature; a high quality dry prairie, bedrock bluff subtype.

ORC-3: This segment is currently used for agricultural "truck farming" No natural resources of significance are known to occur.

G. Grey Cloud Terrace

1. General Description

A wide variety of natural communities make up this segment. In the north portion, representative plant communities include emergent marsh, lowland forest and dry prairie. For the most part these communities are of low quality because of their degree of disturbance. The wooded bluffs adjacent to Grey Cloud Channel contain many homes but the forest continues to maintain a relatively good diversity of tree species. To the east of the golf course is very significant natural feature mapped by the MNDNR County Biological Survey and has recently become a Scientific and Natural Area. This dry prairie-sand gravel subtype has many state listed plant and animal records.

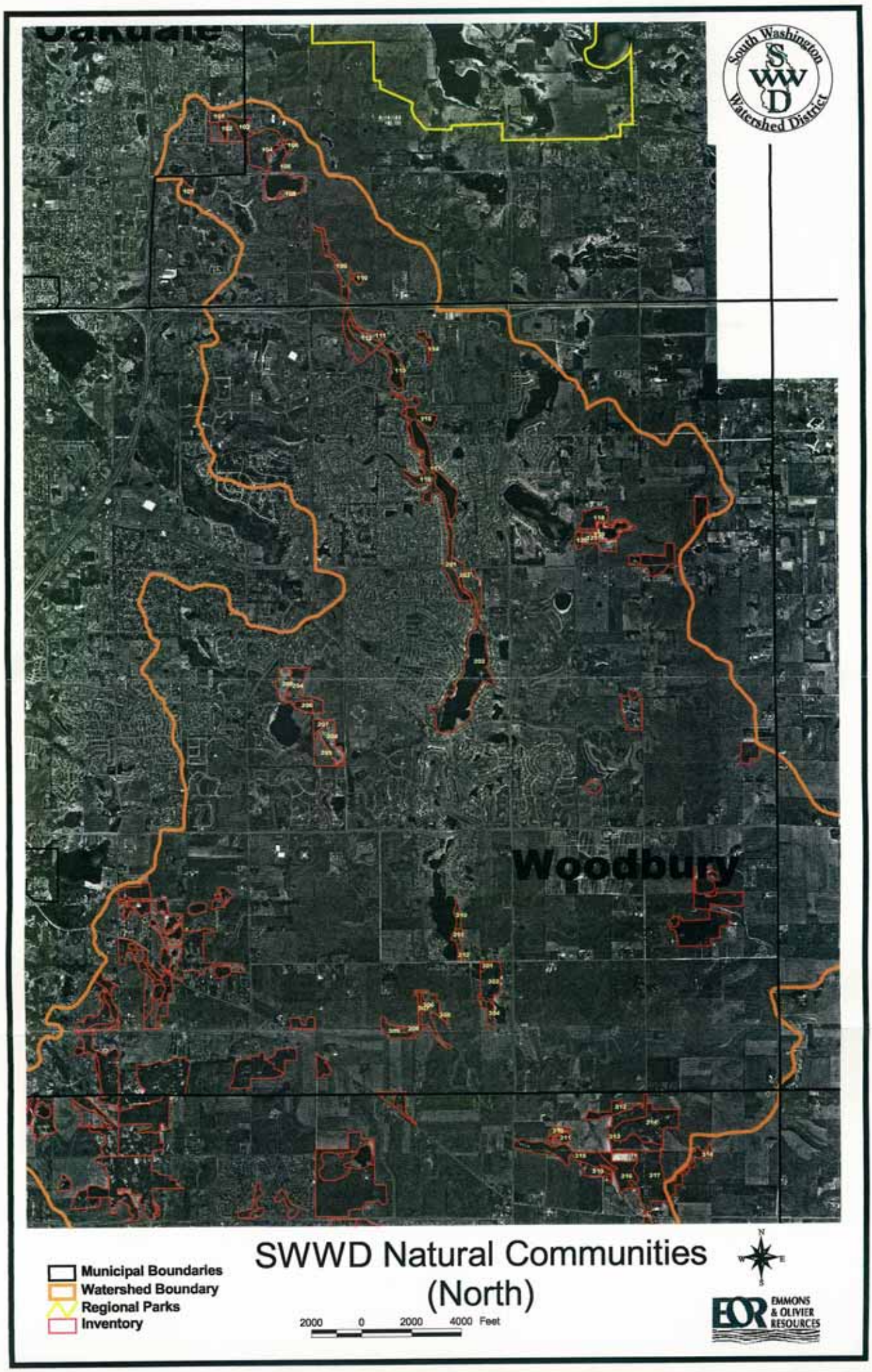
The boundary of this segment was established almost entirely by incorporating the site information from the Cottage Grove Natural Resource Inventory. The boundaries from each individual plant community were merged together to delineate this segment. One exception being the golf course, which was left out of the greenway corridor. This segment provides an important link to Grey Cloud Island and the Mississippi River.

2. Description of Landscape Units

GCT-1: This segment is described as site 19 of the Cottage Grove Natural Resources Inventory. This segment is dominated by brushy old fields and contains some rather extensive areas of dry prairie (sand, gravel subtype). This area is also unique in that populations of prairie associates such as prairie skinks (*Eumeces septentrionalis)* and rare species such as fox snake (*Elaphe vulpina)* and bull snake *(Pituophis melanoleucus)* occur. The DNR Natural Heritage Program maps the large sand gravel prairie (community 19B) as a high quality natural community.

GCT-2: This segment is described as site 21 in the Cottage Grove Natural Resource Inventory. This segment contains the largest and highest quality praire in the SWWD and one the highest quality prairies in the Twin Cities Area. A total of six state listed plant species and two listed animal species are known from this general area. In addition, the DNR Natural Heritage Program maps the sand gravel prairie on the Map of Rare Features for Washington County. This site has recently been purchased by the DNR from the Ashland Oil Company is now known as the Grey Cloud Dunes Scientific and Natural Area. In addition to the large prairie, this segment also includes abandoned gravel pits, old fields, emergent marsh/wet meadow, mesic oak forest, oak woodland, lowland hardwood forest and conifer plantation.

GCT-3: This segment, which connects to the Grey Cloud Channel and Grey Cloud Island contains a mixture of good to moderate quality mesic oak and maple basswood forest. Although large-lot residential home sites fragment much of this area, the quality of these forest communities remains relatively good. An additional noteworthly feature of this area is unique rock outcroppings along the Grey Cloud Channel.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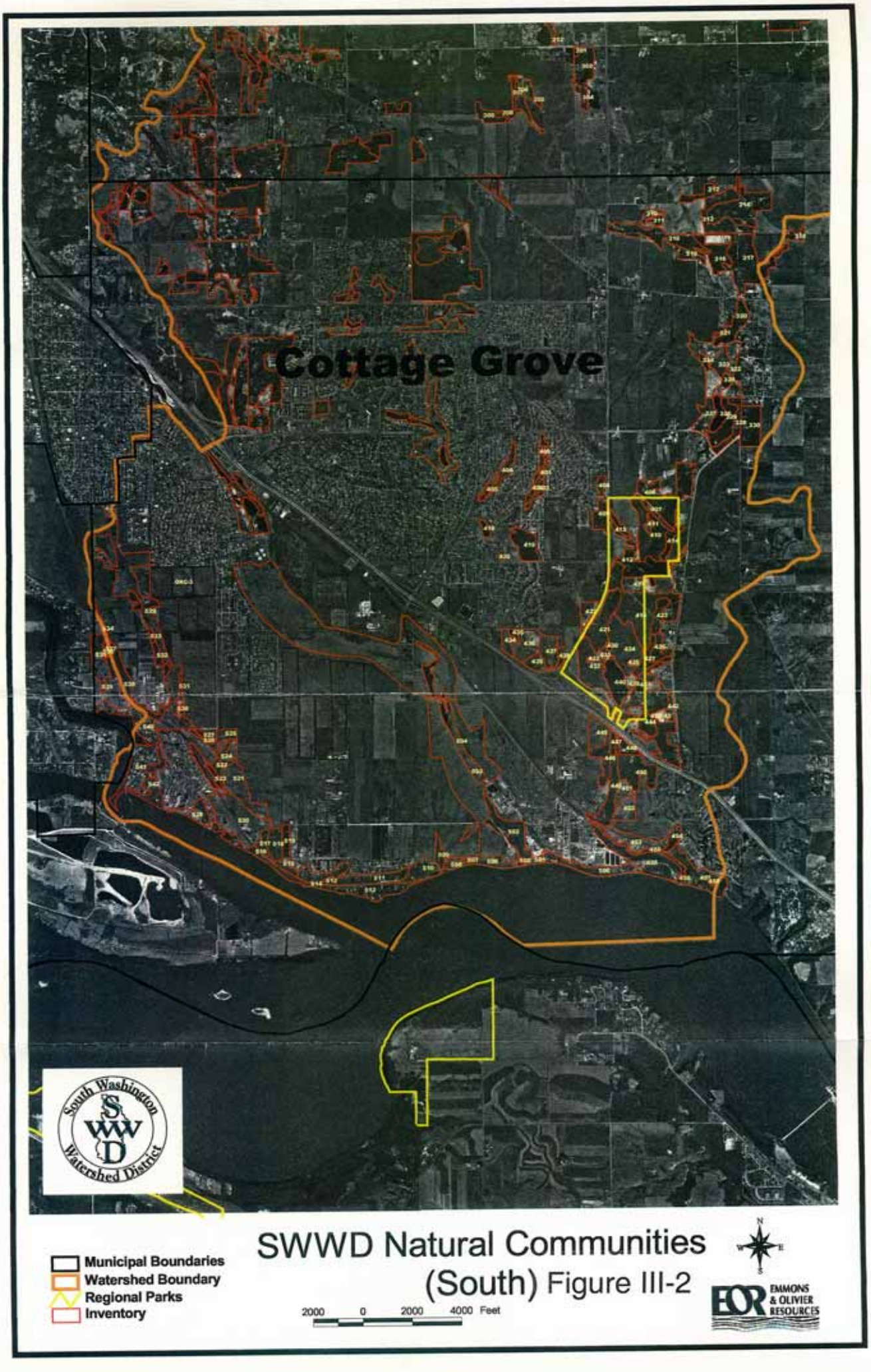
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(South) Figure III-2
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IV. Recommendations

A. Suggested Standards for Corridor Design

To provide a framework for discussion of corridor design standards, the corridor is laterally into three zones. The location, physical dimensions, vegetative cover and stewardship of these zones are described below. Figures IV-1 and IV-2 provide a conceptual plan view and cross-sectional view of a corridor based on a suggested corridor width of 300-feet.

- *Inner Zone:* Interior zone of corridor is fully within protective easement or public ownership. Passive uses emphasized. Native landscaping emphasized to serve as wildlife habitat. Storm water treatment and conveyance facilities occur within this zone with emphasis on natural wetland treatment/infiltration systems and waterways.

- *Transition Zone:* The transition zone defines the outer boundary of protective easement or public ownership. Active recreational uses, if present, are confined to this zone to avoid conflicts with passive uses. Native landscaping emphasized, if not in conflict with adjacent land uses. Features designed to facilitate corridor management including maintenance roads and fire breaks confined to this zone.

- *Outer Zone:* Outer zone is in private or public ownership. Structures and major grading subject to minimum setbacks from corridor transition zone edge. Landowners are encouraged to utilize native landscaping.

Physical Dimensions of Corridor

A review of literature on corridors for wildlife suggests that a minimum width of 300 feet is required to provide for wildlife habitat. Wider corridors generally provide habitat for a higher diversity of wildlife species and offer greater security for species migrating between scattered patches of habitat. Even in relatively large tracts of habitat, such as some of the larger wooded areas scattered thoughout southern Washington County, populations of some species, especially interior species, or those that require very specialized habitat conditions may be declining due to lack of connection to other areas of habitat or lack of a sufficient gene pool to support the population.

The literature on corridor widths for water quality protection is inconclusive; however, most sources suggest fifty feet as a starting point with additional distance factored in for slope and soil credibility. In considering the width of the corridor for storm water management, it is assumed that in most cases, the corridor will need to accommodate storm water ponds and waterways. The corridor may also need to accommodate trails and other recreational facilities. Since the corridor is proposed to serve multiple purposes, a width of 300-feet or more is recommended. Where the corridor is less than 300-feet, it is suggested that active recreational uses be located along roadway edges to minimize conflicts between passive and active uses.

It is recommended that the three zones consist of the following:

Zone	Width (ft)
Interior	200 (minimum)
Transition	100 (50 feet on each side)
Outer	30 (structure setback on each side)

Vegetation

Presettlement vegetation for the corridor is shown in Figure IV-6. Natural communities are closely associated with physiographic features such as soils, slope, and aspect as well as other landscape features such as lakes, ravines and human-created environments. The dominant plant communities prior to European settlement include oak woodland, oak savanna and prairie. It is recommended that where reclamation or restoration of native plant communities is undertaken, that presettlement vegetation distribution be used as a guide to plant community establishment and species selection. Further consideration should be given to physiographic features within major vegetation units to determine if dry, mesic or wet conditions prevail so that reclamation efforts may be custom-tailored to the site.

Road Crossings

Road and other crossings are impediments to movement by plants, animals and people living or traveling within, the corridor. In particular, small mammal, reptiles and amphibians are susceptible to high mortality as they travel between different habitat components in the corridor. Many species such as Blanding's turtles travel great distances to traditional nesting sites and are at increased risk during these migrations. Larger wildlife species, such as whitetail deer, may pose a safety concern due to the potential for vehicle-deer collisions. Although difficult to implement for existing road crossings, some of the suggested crossing designs may be considered for new roads:

- Oversized Box Culverts: Box culverts or other large pipes placed at road crossings may be used by wildlife if light or visibility is present though the opposite end of the culvert. If a watercourse is part of the corridor, ideally, the box culvert should be large enough to accommodate a natural channel that conveys small storm event. The floor of the box culvert should consist of local soil. Large culverts may also be able to accommodate movement of people if property sized. If a stream flows though the culvert, placement of sand, gravel and rock substrate material will enhance the ability of fish and macro invertebrates to move though.

- Grated Trenches: Some species (such as many amphibians) will not use crossings not exposed to the sky. These species require a grate or other material that allows the sky to show through.

- Vegetated Overpasses: Overpasses can be constructed with soil and vegetation to provide and open, unhindered path over the roadway. Vegetated overpasses are the best alternative due to the exposure to light, ability to move people.

- Fencing: Fencing may be used to discourage travel at one location while funneling species into a crossing structure at another. In order to be effective, fence material must be of small enough mesh size, be tall enough and be buried deep enough to discourage animals from digging underneath. Vegetation may also be used to funnel wildlife and provide cover near the entrance to the overpass or culvert.

- Deer Reflectors: Deer reflectors are known to be effective at reducing deer-car collusions when placed at known deer crossing locations along highway shoulders. Deer reflectors provide a low cost alternative to reducing deer/car collusions and should be applied either alone or in combination with other measures.

Stewardship of Natural Areas
Appendix C provides detailed information on stewardship of natural communities in the corridor. Placement of trails, storm water conveyance facilities and tree and shrub seedlings should be carefully planned to facilitate future management activities. For example, prairies should be planted to allow for such maintenance activities as mowing and prescribed burning. Avoid where possible creating more "edge" than necessary. Edges are often where invasive species get their foothold.

Recreational Uses
The primary recreational activities anticipated are those associated with recreational trail systems such as walking, rollerblading, and biking. Where possible, active recreational activities should be limited to the transition zone of the corridor, leaving the interior portion for more passive uses. Where the corridor is less than 300-feet in width, recreational uses should be located outside of the corridor.

B. Land Protection Tools
While many land protection tools exist to implement the SWWD Greenway Corridor, the primary land protection tools identified in the Chisago-Washington Green Corridor Project include the following:

Donated Conservation Easements: A conservation easement is the voluntary and permanent transfer of specified development and land use rights from a landowner to a qualifying organization. In Minnesota, the legal basis of easements as a conservation tool is provided for in Chapter 84C of the Minnesota Statutes, which states that a conservation easement may be established on land in order to "assure its availability for agricultural, forest, recreational or open space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving historical, architectural, archaeological or cultural aspects. To be eligible for an easement, land must be evaluated by a conservation organization and determined to have qualities that serve these purposes.

Purchased Development Rights (PDR): A PDR is a voluntary, legal agreement that allows landowners meeting certain criteria to sell the right to develop their property to a township, city, county, state government, or nonprofit organization. A conservation easement is then placed on the land.

Transferred Development Rights (TDR): A TDR is an ordinance created by a local unit of government that provides for the creation of a sending, or preservation area, and a receiving, or higher density area. Landowners in the sending area receive development right credits, which they can sell in exchange for not developing their land. Real estate developers can then purchase development right credits and use them to increase existing or planned densities in the receiving areas.

Park Dedication: Use of park dedication funds is an appropriate financial resource for establishment of the Greenway Corridor where the Corridor is consistent with the local City Park and Open Space Plan.

Land Acquisition: Land acquisition may be used where landowners want to conserve their land by selling fee title to a public agency. In some cases, desired functions of the corridor may be inconsistent with use of conservation easements, or, highly sensitive areas may be better protected though full ownership.

Miscellaneous Easements: Where development abuts sensitive or aesthetically important areas, such as steep slopes, flood plain, shallow bedrock areas or other significant features, easements may be acquired from property owners. This may be accomplished with both existing and future developments.

C. Corridor Segment Recommendations

The following are recommendations for each segment of the corridor. These recommendations highlight key activities needed to establish a continuous corridor that provides for local values determined to be important to the SWWD. A general overview of specific challenges is provided for each segment, followed by more specific implementation steps.

Wilmes Lake

The north portion of the Wilmes Lake segment is incomplete with few established connections. The first gap in the corridor occurs between Armstrong Lake and Lake Elmo Park Reserve. The second major gap occurs between Armstrong Lake and I-94. Intensive land use and high property value for freeway frontage make greenway establishment difficult in this area. From I-94 south to Wilmes Lake, the corridor is quite narrow in spots but for the most part adequately established. The interstate provides a real challenge in so far as allowing wildlife and humans to travel across this obstruction. A storm sewer pipe conveys water from the north to the south but as far as wildlife and recreation is concerned, Highway 94 effectively severs the corridor. Although this gap in the corridor is small, it is one of the most important missing links in the corridor.

Specific recommendations for the Wilmes Lake segment include:

1. Work with landowners and developers and Washington County Parks to acquire easements or deed restrictions to WL-1, providing link from Armstrong Lake to LakeElmo Park Reserve.

2. Work with landowners around Armstrong Lake to maintain buffers of native vegetation around lake.

3. Evaluate options for Hwy. 94 Wildlife/People crossing. The existing pipe at this crossing is a 72-inch RCP. This pipe is potentially large enough to accommodate some wildlife movement, but unfortunately lacks proper substrate, and has a steep gradient. In addition, the length of this pipe and lack of light inhibit movement for most species. This pipe should be evaluated for possible improvements. An option that would possibly serve both wildlife and recreational uses is a vegetated overpass.

4. Contact State Farm Insurance to determine interest in placement of prairie restoration site (along Hwy. 94) in conservation easement within corridor. This site is an ideal "show piece" for public/private collaboration.

Colby Lake

A problematic area exists between Colby Lake and Bailey Lake. This segment of the corridor is fully developed and as a result, options for making this connection are limited. Ideally, the greenway corridor would follow the storm water route directly south to Bailey Lake through an existing golf course. The golf course; however, has not indicated an interest in pursuing this option. A proposed alternative route would be to route the corridor to the west through school property and then south through the Bailey Ridge wetland. Another alternative would be to “swap” land with the golf course to enable a more direct route to Bailey Lake.

Specific recommendations for the Colby Lake Segment are:

1. Work with landowners and Woodbury Parks to establish native vegetation both upland and lake fringe) within landscape unit CL-1. The City and Landowners may be eligible for the Neighborhood Wilds Program through DNR.

2. Within Landscape Unit CL-2 and CL-3, work with landowners and Woodbury Public Schools to place the corridor in a conservation easement. Restore to native vegetation.

3. CL-5 is currently owned by City of Woodbury. Encourage establishment of native vegetation.

4. CL-4: Work with landowners and developers to establish conservation easements or deed restrictions in corridor. Restore to native vegetation.

5. CL-5 (Bailey Lake) is currently owned by the City of Woodbury with easements up to the 100-year flood elevation. Additional easements including upland should be considered. The east side of the lake contains large bur oak and would be ideal site for an oak savanna restoration. The west side of the lake should be restored as oak woodland.

Gables Lake

An east and west alignment is identified for this segment. The west segment includes a large infiltration ponding area (CD-P86) that could, if necessary, discharge south, across Military Road and then to Cottage Grove Ravine Park. This segment is a major storm water infiltration and conveyance route, but also serves as a key link between Cottage Grove Ravine Park and natural areas to the north.

Key portions of the Gables Lake West Segment include GL-W1 and GL-W5. This segment provides an ideal site for a large-scale natural community reclamation project in collaboration with development of CD-P86. According to the original land survey, the northernmost portion of this segment would be suited to oak savanna and woodland. The southern portion of the site is suited to mesic prairie.

The Gables Lake East Segment includes a large area of oak forest and woodland within an area of large-lot residential development. The preferred approach to this segment is to work with landowners to develop a stewardship plan to minimize impacts from residential development. Neighborhood Wilds, a DNR-sponsored program that works with groups of landowners to create stewardship plans for multiple parcels is ideally suited to this area. At the time of this report; however, this program is not being funded.

Specific Recommendations are:

Gables Lake - West

1. Work with landowners and developers in GL-W1 to acquire conservation easements and deed restrictions. Restore to native vegetation.

2. At the boundary between Cottage Grove and Woodbury, a small oak savanna remnant occurs along a steep ridge. This oak savanna contains a moderate diversity of savanna forbs, a few mature bur oak and numerous pole-sized bur oak saplings. This site offers an excellent opportunity to restore the presettlement oak savanna that once occupied this part of Washington County.

3. GL-W2 and GL-W3 are presently owned by the City of Woodbury and include storm water ponding, a lift station and an infiltration basin. The entire area should be restored to a mixture of oak woodland, oak savanna, prairie and wetland.

4. The portion of GL-W5 north of Military Road encompasses CD-P 86, a large infiltration area. A preliminary management plan has already been developed for this site with infiltration wetlands and oak savanna/prairie buffers proposed. A DNR Greenway Acquisition Grant has been submitted for this project.

5. The portion of GL-W5 south of Military Road includes additional infiltration areas. Unlike the area north of Military Road, no management plan has been developed. The SWWD should work with landowners and developers to establish a corridor through this area in accordance with suggested standards.

Gables Lake - East

1. The north side of Gables Lake contains a remnant oak savanna with good restoration potential. The SWWD should work with 3M to place a conservation easement on this area and implement restoration. A westerly connection to CL-W5 should also be completed.

2. CL-E2, CL-E3, and CL-E4 include a large contiguous area of forest, savanna, prairie and wetland. The SWWD in cooperation with DNR should work with neighborhoods and landowners through the Neighborhood Wilds Program. Neighborhood Wilds, a DNR-sponsored program that works with groups of landowners to create stewardship plans for multiple parcels is ideally suited to this area. At the time of this report; however, this program is not being funded.

3. The entire Gables Lake-East corridor segment has potential to contain additional population of Kittentails (Official Status-Endangered). Follow-up surveys should be conducted to identify these potential populations.

4. As part of Neighborhood Wilds Program effort, landowners should be contacted to determine interest in establishing protected corridor through conservation easements.

Cottage Grove Ravine
Natural features and county property make up the entire northern part of this segment. Natural features and 3M property make up the entire southern part. From an ecological perspective the only missing link in this segment is the barrier created by Highway 61. Crossing two lanes of State Highway is extremely dangerous for wildlife and essentially severs the corridor. From a recreational perspective there is no potential for the corridor south of the highway.

1. CGR-1 - Work with landowners and future developers to establish a corridor with restoration to native vegetation.

2. CGR-3, CGR-4, CGR-5 - SWWD should collaborate with DNR to work with landowners through Neighborhood Wilds Program. Landowners should be encouraged to adopt stewardship strategies for Natural Communities as identified in Appendix C.

3. CGR-2 - SWWD should collaborate work with Washington County and DNR to develop a Natural Resource Management Plan for the park. The plan should be developed to address multiple issues including storm water management, vegetation management, and erosion and wildlife management.

3. CGR-6 - The Watershed should work with 3M and the DNR Natural Heritage Program to develop a Natural Resource Management Plan. The Plan should address multiple issues including erosion, storm water management, and natural resources.

4. The culvert crossing at Highway 61 consists of a 6x6 foot concrete box culvert and then connects to a 72 inch RCP. A recent inspection suggests minimal use by wildlife due to the relatively small size, length and lack of light in the culvert. In addition, approximately one third of the culvert is filled with sediment. As with the I-94 crossing to the north, a vegetated overpass or larger culvert crossing would be needed to significantly eliminate this break in the corridor.

Mississippi River Bluffs
This segment links three segments along the Mississippi River. Its heavily wooded steep slopes provide adequate cover to be considered a wildlife corridor. In terms of recreational opportunities this whole segment is a missing link. All of the property along the bluff is private and the largest owner being 3M.

Specific recommendations include:

1. The SWWD should work with landowners and DNR through the "Neighborhood Wilds" program to develop bluffline stewardship plans for appropriate bluff segments.

2. As part of the "Neighborhood Wilds" program conservation easements should be obtained, especially for unique natural communities such as bedrock, bluff, prairie and steep slopes.

3. The bluffline should be evaluated for erosion problem areas. An erosion control ravine stabilization plan should be developed to address problem areas.

Old River Channel
The Old River Channel segment serves as an ideal link between Cottage Grove Ravine Park and the southeast side of Cottage Grove including Grey Cloud Dunes SNA and Grey Cloud Island. This corridor also provides a link to the bluffline of Camel's Hump and the West Draw.

Specific recommendations include:

1. The SWWD should work with landowners and developers to create a continuous corridor through this segment. Ideally, the corridor should encompass the entire glacial river channel. If that is not feasible, the corridor should encompass all wetlands and the slope along the south side of the channel where scattered prairie remnants exist.

2. A connection between Cottage Grove Ravine Park and the Old River Channel is needed to link recreational and ecological functions. The suggested route is from the Cottage Grove Ravine Park, west to the drive-in theater and then southwest across Hwy. 61. From this point the corridor should link into the Old River Channel near Langdon Pond.

Grey Cloud Terrace
A good portion of this segment is already preserved in the Grey Cloud Dunes Scientific and Natural Area (SNA). The major focus of this segment is on the terrace ridge to the north of the SNA and on forest areas near the Upper Grey Cloud Channel

The following are specific recommendations:

1. The entire terrace slope, denoted as GCT-1, should be placed in a conservation easement. This slope contains several good quality sand-gravel prairies and provides excellent opportunities for prairie restoration.

2. The SWWD should collaborate with DNR and the National Park Service (Mississippi River Critical Area), to develop a stewardship plan for GCT.3 through the Neighborhood Wilds Program.

SWWD GREENWAY CONCEPT

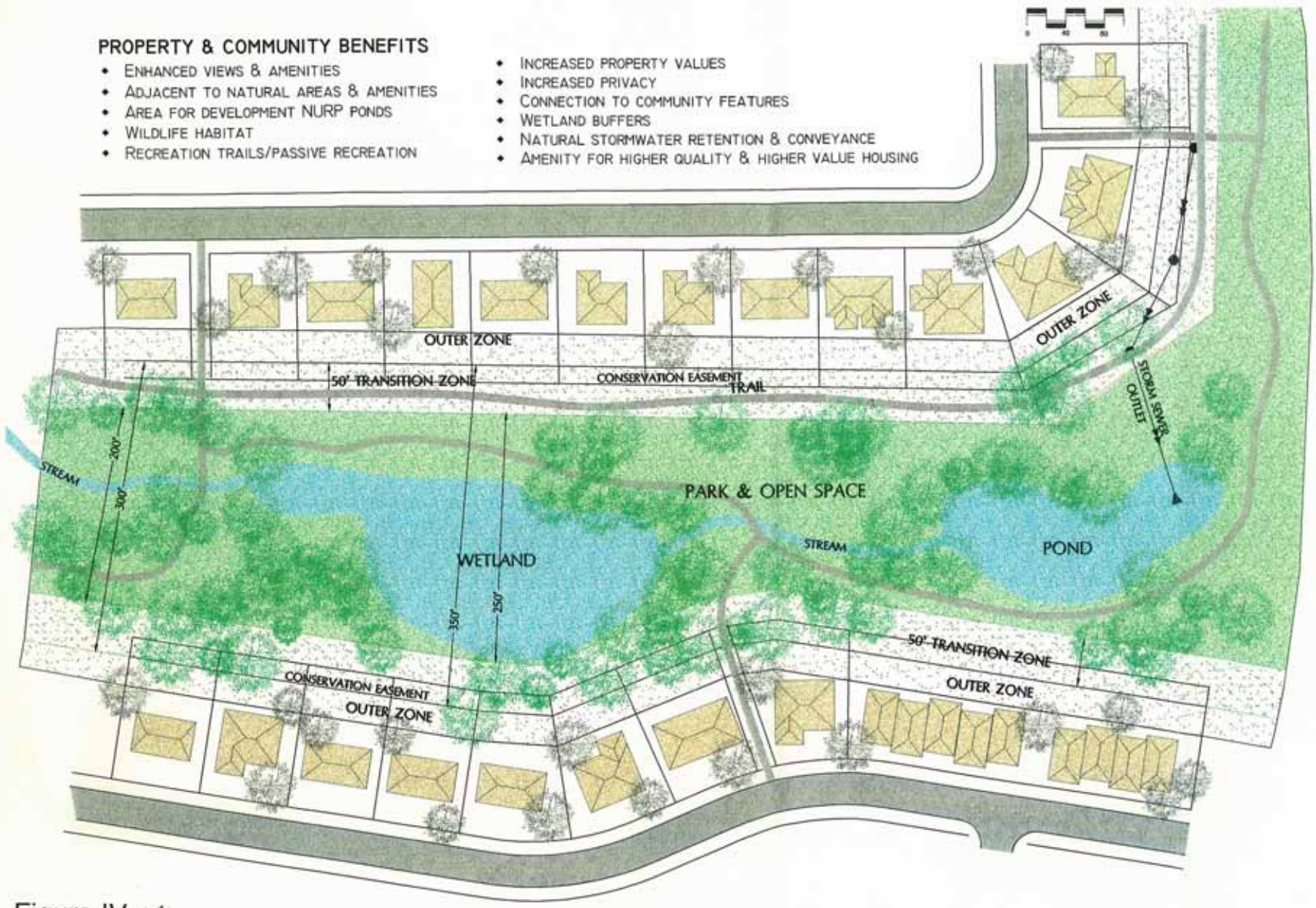
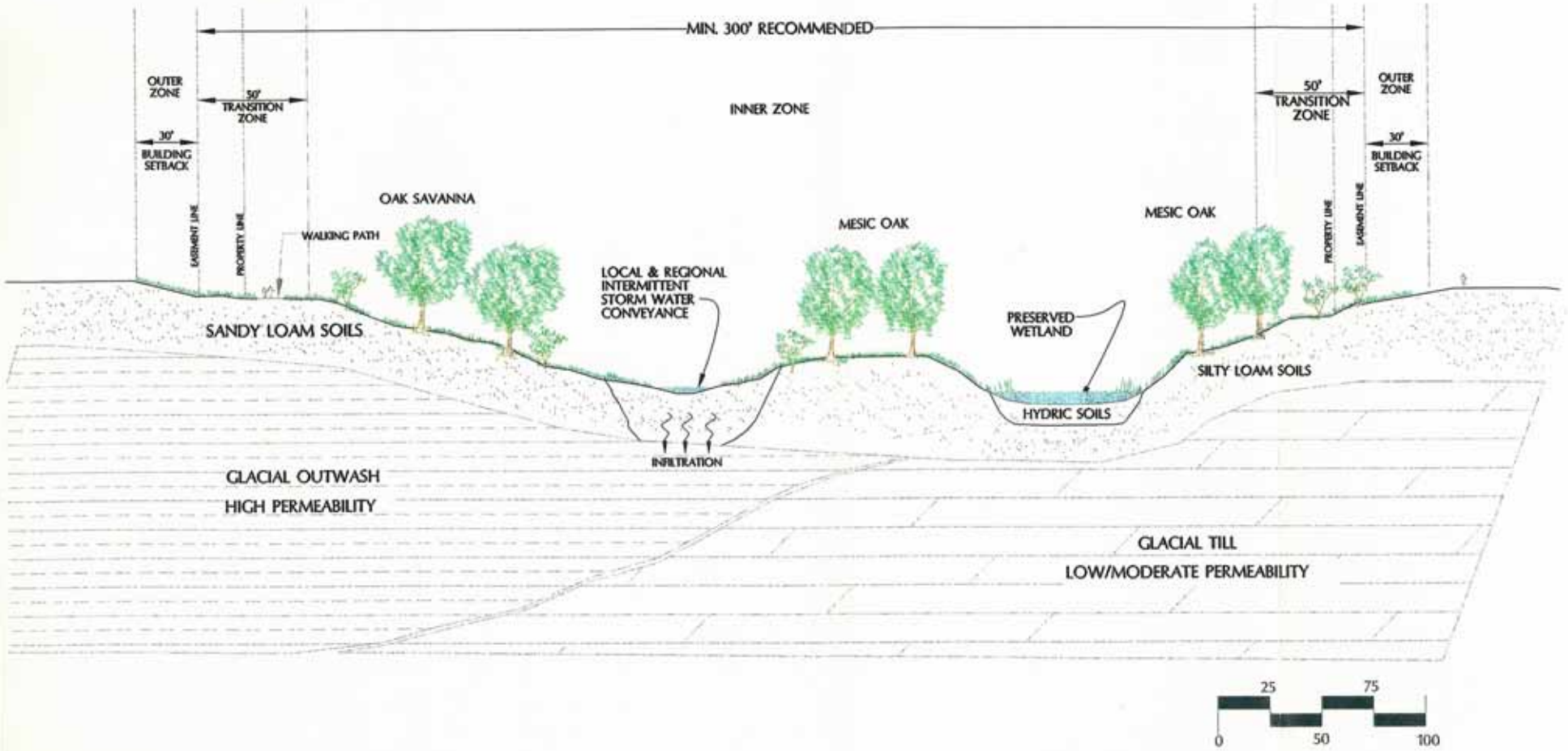


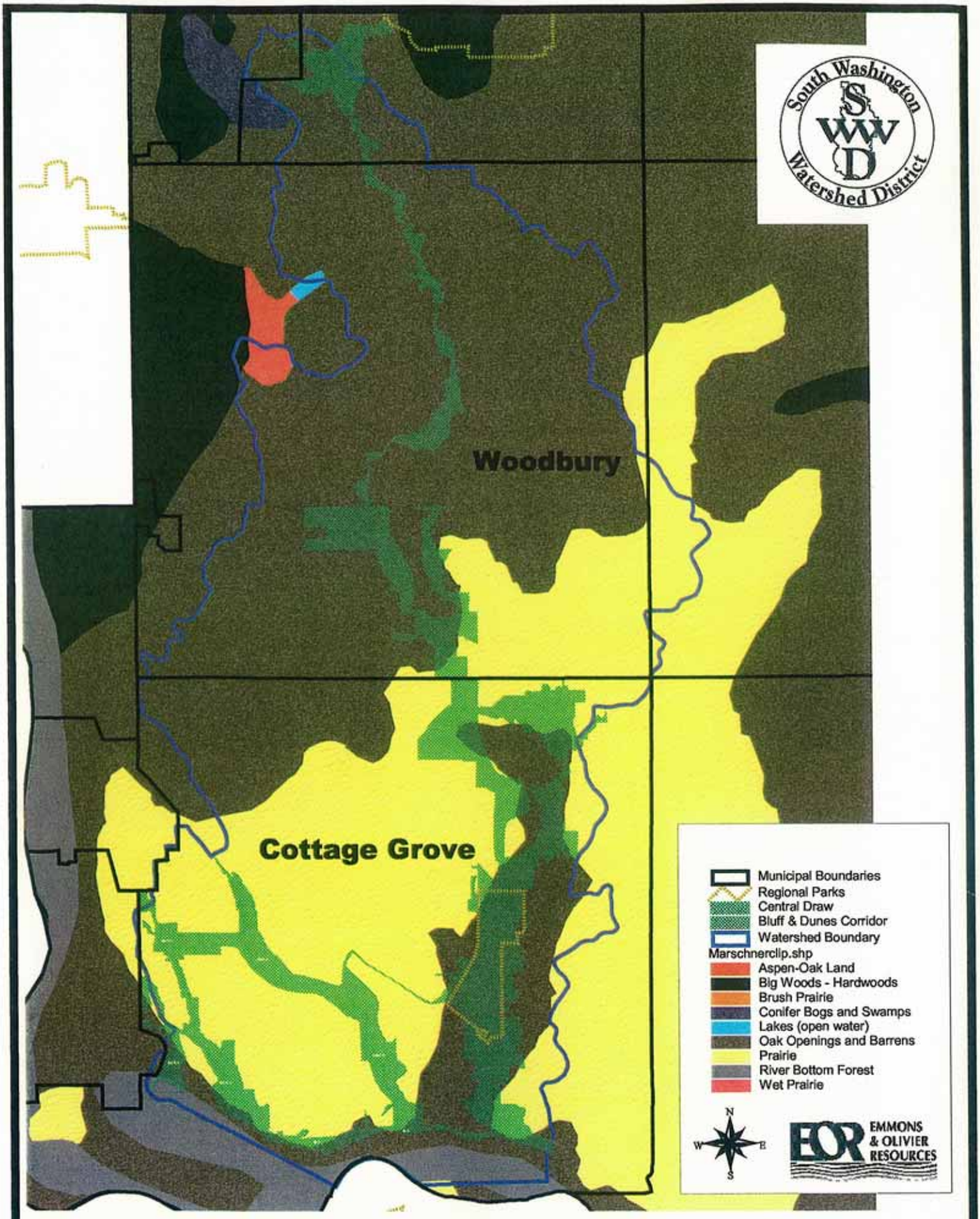
Figure IV - 1
PLAN VIEW - SURFACE REGIONAL & LOCAL FLOW



SWWD GREENWAY CONCEPT

Figure IV - 2

CROSS-SECTIONAL VIEW - SURFACE REGIONAL & LOCAL FLOW



Marschner Presettlement Vegetation **Figure IV-6**

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Appendix A
Corridor Segment Tables

Corridor Segment Tables

Classification and Qualitative Ranking of Natural Communities

All natural communities were classified in accordance with *Minnesota's Native Vegetation, A Key to Natural Communities* (MN DNR Biological Report No. 20, 1993). The communities were then assigned a qualitative ranking (EO rank) in accordance with *Element Occurrence Ranking Guidelines* (MN DNR Natural Heritage Program). This ranking system is based primarily on species composition and diversity, ecological structure and disturbance indicators. A natural community that exists in pre-settlement condition would be given an "A", while a severely degraded natural community would be given a "D". One criterion that was not used for this project is minimum size standards. Communities that are not "natural," that is, they were not a component of the pre-settlement landscape and are instead entirely the result of European alterations to the landscape, were not ranked; these communities are noted as Not Applicable (NA) in the ranking tables.

Minnesota Land Cover Classification System (MLCC)

This system was developed by the MN DNR as a way to map all land cover types in the state; the hierarchical system can be applied at varying degrees of detail, depending on the level of specificity desired. Using this system provides compatibility between this report and similar planning efforts around the state and metro area, by establishing a uniform set of definitions and categories for cover types. The system encompasses the DNR Natural Heritage Program natural community classifications but differs in that it does not provide a qualitative assessment. It does, however, include non-native communities and human created cover types that are omitted from the Natural Heritage system. All of the sites surveyed were assigned the appropriate MLCC code based on version 9.30 of the system.

The following tables summarize the Community type and Land Cover for communities within the proposed corridor. Some of these sites were field inventoried as part of the South Washington Watershed District Greenways Project. Others were surveyed during the Cottage Grove Natural Resources Inventory or the Woodbury Natural Resources Inventory, and more information about the latter sites is available in the reports for those projects.

Summary Table for the Wilmes Lake Segment*

Site Attributes			
Site	Community type	MLCC	EO Rank
101	Disturbed Deciduous Woodland	42130	NR
102	Conifer Plantation	21113	NR
103	Lowland Hardwood Forest	32330	D
104	Old Field	23200	NR
105	Saturated Vegetation, non-native dominated (Reed Canary Grass Wet Meadow); Lake; and Emergent Fringe	61480; 9300; 61710	D
106	Oak Woodland	42120	D
107	Mesic Oak forest	32112	CD
108	Oak Woodland	42120	D
109	Lowland Hardwood Forest	32330	D
110	Deep Open Water Marsh	92500	NR
111	Old Field	23200	NR
112	Saturated Vegetation, non-native dominated (Reed Canary Grass wet meadow)	61480	D
113	Deep Open Water Marsh	93000	D
114	Dry Oak Forest	32110	D
115	Dry Oak Forest	32110	CD
116	Mixed Hardwood Forest	42130	NR

Natural Community Data Gathered by the South Washington Watershed District in 1999

Summary Table for the Colby Lake Segment*

Site Attributes			
Site	Community type	MLCC	Rank
201	Dry Oak Forest	32110	D
202	Colby Lake Park: Planted Grasses	23210	NA
203	Saturated Vegetation, non-native dominated (Reed Canary Grass Wet Meadow)	61480	D
204	Oak Woodland	42120	C
205	Wet Prairie/ Emergent Marsh	61600	C
206	Disturbed Deciduous Woodland	42130	NA
207	Lowland Hardwood Forest	32330	B/C
208	Saturated Vegetation, non-native dominated (Reed Canary Grass Wet Meadow)	61480	NA
209	Old Field	23200	NA
210	Dry Oak Forest	32110	C
211	Oak Woodland-Brushland	42120	D
212	Old Field	23200	NA

Natural Community Data Gathered by the South Washington Watershed District in 1999

Summary Table for the Gables Lake Segment

Site Attributes			
Site	Community type	MLCC	Rank
301*	Open Water/ Emergent Marsh	61600	NA
302*	Mesic Oak Forest	32110	D
303*	Conifer Plantation	21110	NA
304*	Conifer Plantation	21110	NA
305*	Lowland Hardwood Forest	32330	D
306*	Deciduous Plantation	21210	NA
307*	Maple Basswood Forest	32150	C
308*	Mesic Oak Forest	32110	C
309*	Dry Oak Savanna (with non-native herbaceous vegetation)	62140	D
310**	Open Water/Emergent Marsh	61600	D
311**	Oak Woodland-Brushland	42120	D
312**	Mesic Oak Forest	32110	C
313**	Oak Woodland-Brushland	42120	D
314**	Basswood Forest	32150	BC
315**	Mesic Oak Forest	32110	C
316**	Mesic Oak Forest	32110	D
317**	Old Field/Prairie	23200	NA
318**	Mesic Oak Forest	32110	C
319**	Oak Woodland-Brushland	42120	D
320**	Dry Oak Savanna (with non-native herbaceous vegetation)	62140	D
321**	Dry Oak Savanna (with non-native herbaceous vegetation)	62140	D
322**	Cultivated Row Crops	24100	NA
323**	Basswood Forest	32150	C
324**	Cattail Marsh & Saturated Vegetation, non-native dominated (Reed Canary Grass Wet Meadow)	61600; 61480	CD
325**	Lake	92000	NA
326**	Mesic Oak Forest	32110	D
327**	Maple -Basswood Forest	32150	C
328**	Mesic Oak Forest	32110	C
329**	Mesic Oak Forest	32110	D

Natural Community data from the Woodbury Natural Resources Inventory, 1997
****Natural Community data from the Cottage Grove Natural Resources Inventory, 1998***

Summary Table for the Cottage Grove Ravine Segment

Site Attributes			
Site	Community type	MLCC	Rank
400	Lowland Hardwood Forest	32330	D
401	Old Field	23200	NA
402	Shrub Swamp	52200	D
403	Dry Prairie	61210	BC
404	Dry Prairie	61210	B
405	Stormwater Pond/Lowland Hardwood Forest	23220	NA
406	Dry Oak Forest	32110	C
407	Utility Line	-------	NA
408	Lowland Hardwood Forest	32330	D
409	Mesic Oak Forest	32110	C
410	Dry Oak Forest	32110	C
411	Old Field	23200	NA
412	Conifer Plantation	21110	NA
413	Low Hardwood Forest	32330	D
414	Conifer Plantation	21110	NA
416	Oak Woodland-Brushland	42120	CD
417	Old Field	23200	NA
418	Stormwater Pond	-------	NA
419	Dry Oak Forest	32110	CD
420	Mixed Emergent Marsh	61720	D
421	Mesic Oak Forest	32110	D
422	Oak Woodland-Brushland	42120	D
423	Lowland Hardwood Forest	32330	D
424	Dry Oak Forest	32110	B
425	Dry Prairie	61210	C
426	Conifer Plantation	21110	NA
427	Mesic Oak Forest	32110	BC
428	Dry Oak Forest	32110	C
429	Picnic Area	23210	NA
430	Open Water/Emergent Marsh	61600	CD
431	Dry Prairie	61210	C
432	Dry Oak Forest	32110	B
433	Dry Prairie	61210	C
434	Old Field	23200	NA
435	Disturbed Deciduous Woodland	42130	NA
436	Drive In	-------	NA
437	Dry Prairie	61210	C
438	Dry Prairie	61210	D
439	Disturbed Deciduous Woodland	42130	NA
440	Lake	92000	NA
441	Conifer Plantation	21110	NA
442	Brushland	62200	NA
443	Residential	-------	NA
444	Conifer Plantation	21110	NA
445	Old Field	23200	NA
446	Oak Woodland-Brushland	42120	C
447	Conifer Plantation	21110	NA
448	Conifer Plantation	21110	NA

449	Mesic Oak Forest	32110	C
450	Dry Oak Forest	32110	BC
451	Old Field	23200	CD
452	Old Field	23200	NA
453	Dry Oak Savanna	62120	B
454	Mesic Oak Forest	32110	B
455	Lowland Hardwood Forest	32330	BC
456	Mesic Oak Forest	32110	B
457	Dry Oak Forest	32110	CD
458	Open Water Marsh	61600	CD
459	Dry Prairie	61210	B

Natural Community data from the Cottage Grove Natural Resources Inventory, 1997

Summary Table for the Mississippi River Bluffs Segment *

Site Attributes			
Site	Community type	MLCC	Rank
500	Oak Woodland-Brushland	42120	D
501	Oak Woodland-Brushland	42120	C
502	Mesic Oak Forest	32110	B
503	Old Field	23200	NA
504	Emergent Marsh/Wet Meadow	61480; 61710	BC
505	Pond	92000	NA
506	Oak Woodland-Brushland	42120	C
507	Dry Prairie	61210	C
508	Mesic Oak Forest	32110	B
509	Basswood Forest	32150	B
510	Mesic Oak Forest	32110	C
511	Dry Oak Forest	32110	D
512	Res. Development	-----	NA
513	Black Ash Seepage Swamp	32310	C
514	Lowland Hardwood Forest	32330	C
515	Mesic Oak Forest	32110	BC
516	Lowland Hardwood Forest	32330	C
517	Oak Woodland-Brushland	42120	C
518	Mesic Oak Forest	32110	CD
519	Conifer Plantation	21110	NA
520	Dry Prairie	61210	AB
521	Old Field/Gravel Pits	23200	NA
522	Lowland Hardwood Forest	32330	D
523	Emergent Marsh/Wet Meadow	61320	B
524	Dry Prairie	61210	AB
525	Disturbed Deciduous Woodland	42130	NA
526	Old Field	23200	NA
527	Conifer Plantation	21110	NA
528	Mesic Oak Forest	32110	D
529	Old Field	23200	NA
530	Gravel Pit	14212	NA
531	Dry Prairie	61210	B
532	Lowland Hardwood Forest	32330	D
533	Open Water/Emergent Marsh	61820	D
534	Dry Prairie	61210	D
535	Dry Prairie	61210	C
536	Open Water Marsh	61820	D
537	Brushland	62200	NA
538	Aspen Forest	32160	D
539	Brushland	62200	NA
540	Mesic Oak Forest	32110	D
541	Maple-Basswood Forest	32150	CD
542	Mesic Oak Forest	32110	D

Natural Community data from the Cottage Grove Natural Resources Inventory, 1997

Appendix B

Land Protection Options

Land Protection Options

Information in this section is from Land Protection Option: A Handbook for Minnesota Landowners. It is reproduced here with permission from the Minnesota Department of Natural Resources Natural Heritage Program.

Conservation Easements

What is a conservation easement?
A conservation easement is the voluntary and permanent transfer of specified development and land use rights from a landowner to a qualifying organization. In Minnesota, the legal basis of easements as a conservation tool is provided for in Chapter 84C of the Minnesota Statutes, which states that a conservation easement may be established on land in order to "assure its availability for agricultural, forest, recreational or open space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving historical, architectural, archaeological or cultural aspects." To be eligible for an easement, land must be evaluated by a conservation organization and determined to have qualities that serve these purposes.

An easement takes the form of a binding contract that is filed in the public records of the county in which the land is located. Terms are negotiated between the landowner and the conservation organization that will "hold" (monitor and enforce) the easement. The landowner who establishes the easement and all future owners of the property are legally obligated to abide by its terms. The organization serves as permanent guardian for the land's conservation values, monitoring the property annually to assure that the terms are upheld. If it should become necessary, the organization is empowered to enforce the easement in court.

The mutually agreed upon restrictions that are placed on the land's development and use will vary with the features that an easement is intended to protect. If an easement was established in order to protect a piece of native prairie, for example, gravel mining would likely be a restricted activity, since gravel mining is a land use that is incompatible with prairies. If an easement were established to protect a property's open space values and rural character, however, an activity such as farming would be allowed (not restricted), since farming is a land use that is perfectly compatible with those values. For lands of outstanding ecological value, especially large tracts of undisturbed natural lands, a landowner and conservation organization may work together to design a highly restrictive easement that provides the land with an appropriate level of protection. In general, the terms of an easement are designed to reflect the wishes of the landowner to the extent possible while providing meaningful protection for the significant features of the land.

Conservation easement provisions may limit:

- structure, construction, location, renovation
- utility expansion

- such uses in other areas covered by the easement
- alteration of water bodies and courses
- removal or alteration of vegetation, except for specified purposes
- extent of recreational use
- extent of motorized vehicle use in specified areas

Easements are sometimes used as part of a so-called "limited development plan," in which an easement is structured so that it allows development on one part of a property while restricting development on another part of the same property. While generally not a viable option for small parcels of land, limited development plans can be a useful tool for conservation-minded real estate developers and local communities that want to provide permanent protection to natural and open space areas within major subdivisions and other areas planned for residential or commercial development.

A landowner may sell or donate an easement. Some conservation organizations have funds available to compensate a landowner for establishing an easement on property of significant conservation value to protect natural features such as forests, wetlands, riverways and native prairie. Donating conservation easements is a popular option for landowners who are:

- interested in the associated potential for income tax deductions
- supportive of conservation
- feel positively about making a donation if it is within their financial means to do so.

Since it restricts a property's development potential, an easement may dramatically reduce its resale value. Although this loss in resale value may be offset to a degree by tax savings, it is nonetheless a very important consideration for landowners.

Key aspects of perpetual conservation easements

- Landowner retains title to the property and all associated rights and obligations of ownership aside from those that are transferred to the organization in the easement.
- Property retains its private status; an easement does not require that land be open to the public unless access has been agreed to by the landowner
- May be donated or sold to a qualifying organization
- Runs with the title to land; all future owners are bound by its terms
- May dramatically reduce property's resale value
- Does not freeze a property's value; values may still be expected to rise over time, although not at the rate of unrestricted properties.

Why choose a perpetual conservation easement?

- Permanent Protection
  A conservation easement provides the benefit of assuring perpetual preservation of invaluable natural, rural or scenic features of your property, enhancing the quality of life for present and future landowners and their surrounding communities and supporting the continued integrity of any existing natural communities. Placing an easement on property prior to donating or selling the land or bequeathing it to your heirs will legally obligate all future owners to care for the land according to your wishes as expressed in the terms of easement.

- Financial Benefits
  A landowner who donates a conservation easement to a qualified organization may be entitled to a significant charitable contribution deduction on his or her income taxes, equal to the amount of any appraised loss of property value that can be attributed to the easement (see Figure 1 below). A landowner who sells an easement derives income from the sale, but is not eligible for any related income tax benefits unless the easement is sold to a qualifying charitable organization at less than fair market value. Any easement, whether donated or sold, has the potential to result in property and estate tax savings for the landowner if it reduces the appraised property value.

Figure 1

	Appraised Property value Before easement	Appraised Property value After easement	Potential income tax deduction for donor
A	$60,000	$12,000	$48,000
B	$348,000	$206,000	$142,000
C	$21,000	$13,500	$7,500
C	$955,000	$486,000	$469,000

Note: Figure represents actual appraisals of four properties before and after donations of conservation easements to the Minnesota Land Trust in the years 1994-1996.

An easement can also serve as a strategy to help a landowners' heirs keep family lands rather than being forced to sell all or a portion of their inheritance in order to cover estate taxes. In Minnesota, on an estate valued at more than $600,000, estate taxes can be as high as 55 percent of the estate. When an easement reduces the appraised value of land in an estate, it accordingly reduces the estate taxes owed and may bring the taxes into a range that heirs can more reasonably pay. When an easement brings the value of the total estate below the $600,000 level, no estate taxes will be owed. These benefits are realized regardless of whether the easement is established during the donor's lifetime or by bequest (in his or her will).

Easements by Bequest
An easement may be donated to an organization by means of the donor's will (referred to as a donation by bequest or by devise). In this instance, the easement is generally signed during the donor's lifetime but does not come into effect until his or her death. Upon the donor's death, provided that the conservation values of the land have not been compromised in the interim, the organization will execute the easement as instructed in the donor's will.

Endowing your Easement
The organization that accepts your perpetual easement accepts a great responsibility: That of annual monitoring and enforcement of the easement to assure that its terms are honored by all present and future owners. In acknowledgment of this responsibility and the associated costs, many landowners choose to make a contribution to the organization that is over and above the easement donation. By making this contribution, a landowner is said to endow the easement.

Some organizations require that their easements be endowed. Others encourage but do not require endowments. The amount of an endowment generally takes into consideration such factors as size of the property and any particular challenges it presents to effective monitoring. Subject to tax law, a landowner may claim an endowment in regard to an easement as a fully deductible charitable contribution.

Land Retirement Program

What is a land retirement program?
A land retirement program provides financial incentives for a landowner to retire land from agricultural production and/or to leave natural lands undeveloped. Although these programs employ some of their strategies already discussed - such as purchase of conservation easements - the term is used here to refer exclusively to those programs administered by governmental agencies at the federal, state and county levels. Some such programs restrict land uses permanently. Others restrict uses for a specified term, such as a 10-year period, after which the landowner may choose to re-enroll in the program or convert the land to alternate uses. Enrolled land must meet eligibility requirements that vary with the focus of each program.

Since many of these programs are legislatively funded, their status relies on the political process. On an ongoing basis, new programs come into existence while others are discontinued, and available funding may vary from year to year.

Key aspects of land retirement programs
- May provide significant income to the landowner
- The vast majority of these programs focus on highly erodible agricultural lands, wetlands and other lands that safeguard water quality and lands that promote habitat for game species.
- Public access to land is generally not an enrollment requirement.

The following list offers a sampling of land retirement programs:

- Debt Cancellation Conservation Easements
  Through this federal program, landowners who have Farmers Home Administration (FmHA) loans secured by real estate may qualify for cancellation of a portion of their debt in exchange for a conservation easement that protects wildlife habitat, wetlands and other conservation values. The amount of the loan forgiven is proportional to the amount of the farm that will be covered by the easement. Permanent easements are the general rule, although in some cases, easements will be allowed of no less than 50 years in duration. For information, contact your local Farmer's Home Administration office, a division of the U.S. Department of Agriculture.

- Reinvest in Minnesota (RIM)Reserve Program
  RIM is a state program that uses a combination of state tax dollars and private donations to fund natural resource protection on both public and private lands. The private lands program of RIM, known as RIM-Reserve, pays landowners for conservation easements that retire fragile and environmentally sensitive lands from agricultural production. RIM-Reserve is administered through the Board of Water and Soil Resources. Interested landowners should apply directly to their local Soil and Water Conservation District office (SWCD).

- Conservation Reserve Program (CRP)
  The federally funded Conservation Reserve Program offers incentives (long-term rental payments and cost-sharing of up to 50 percent) to farmers who retire highly erodible farmland from production and establish permanent grass or forest cover on the land. Duration of agreements range from 10 to 30 years. Fields must meet eligibility requirements, and there is a limit to the number of acres admitted into the program each year. For information, contact your local Natural Resource Conservation Service (Note: This agency was previously known as the Soil Conservation Services or SCS).

Why choose a land retirement program?

- A Sound Business Decision for Agricultural Lands
  Land retirement programs can be an important part of an overall land use plan for those engaged in crop farming and livestock enterprises. Periodic retirement from grazing and crop farming can benefit long-term soil productivity in instances where the landowner intends to return the land to active use upon completion of its enrollment term. Such programs can also provide a farmer with an alternative means of deriving income from marginal agricultural lands - lands that require excessive labor for little return.

  Land retirement programs provide a landowner with a certain amount of reliable income that is not subject to weather and market conditions. While it may not equal the income that might have been generated from working the land in a good year, it may prove to be an important source of income during unfavorable years.

In this way, such programs offer a hedge against the risks commonly associated with farming.

- Flexibility
  Many land retirement programs restrict uses only for a period of years and do not limit a landowner's long-term choices regarding land use. At the completion of the enrollment term, the landowner may, if desired, convert the land to other uses.

- Environmental Benefits
  Land retirement programs make an important contribution to the state's water quality by reducing the influx of chemicals and sediments into waterways. They also benefit wildlife, particularly waterfowl and nesting grassland birds. Greatest environmental benefits are derived from those land retirement programs that permanently restrict land use.

Restoration Cost-Share Programs

What is a restoration cost-share program?
A restoration cost-share program compensates a landowner for a percentage of the cost involved in projects undertaken to restore and protect natural areas on private lands. The majority of such programs focus on:

- Protection of wetlands and their associated upland communities
- Habitat enhancement for game species
- Management of forest lands for timber production, and
- Selected conservation practices on lands enrolled in land retirement programs.

Cost-sharing is provided for a variety of landowner activities, including establishment of vegetative ground cover for erosion control, restoration of drained and degraded wetlands, and planting of native trees and shrubs. As is the case with land retirement programs, restoration cost-share programs are typically offered through government agencies and, therefore, are subject to similar limitations as to funding and availability.

Key aspects of restoration cost-share programs:
- Compensate landowners for a percentage of labor and material
- costs associated with specified restoration efforts
- Administered through government agencies, sometimes in
- cooperation with private conservation organizations
- Programs and availability of funding subject to frequent change,
- depending on legislative appropriations and the political process
- Landowners commonly piggy-back cost-share funds from different sources, e.g., obtaining a 50 percent cost-share from a federal program, and financing the remaining 50 percent through state or local sources.

The following represents a sampling of restoration cost-share programs:

- Partners for Wildlife
  Administered by the U.S. Fish and Wildlife Service, this federal program offers many restoration-related services to private landowners, specializing in restoration efforts on wetlands and adjacent natural communities such as bottomland hardwood forests, native grasslands, and oak savanna. A highlight of Partners for Wildlife is its wetland restoration program that will cover 50 percent or more of the costs of restoring a previously drained wetland. Services vary from technical assistance to actual restoration (excavation, installation, landscaping, planting of upland vegetation). For information about Partners for Wildlife, contact: Branch of Private Lands, U.S. Fish and Wildlife Service, Whipple Federal Building, 1 Federal Drive, Fort Snelling, MN, 55111. Phone: (612) 725-3570

- Pheasant Habitat Improvement Program
  Funded through Minnesota pheasant stamp hunting fees, this program offers cost-sharing of up to 75 percent for management that improves habitat for pheasant populations, including such activities as plantings for food, nesting cover and woody cover. Plantings of native vegetation (such as prairie grasses) may, in some cases, qualify for funding through this program. For information, contact the Minnesota DNR Section of Wildlife, central office phone (612) 296-3344, or your local DNR Wildlife Manager.

- Stewardship Incentives Program (SIP)
  This program offers cost-share of up to 75 percent for conservation projects of non-industrial private forest lands. Property must have a minimum of 20 acres of forested land. Landowners become eligible for SIP cost-share funds by first working in voluntary partnership with a DNR Forester (or other approved conservation professional) to set up a comprehensive Forest Stewardship Plan for their land. The plan identifies broad management objectives that encompass the landowner's interests and foster the health and vitality of the property's natural communities, with a primary - although not exclusive - focus on enhancement of forested lands. Projects that fall within the framework of this plan are then eligible for cost-share funds and technical assistance through the Stewardship Incentives Program. SIP cost-share funds have been granted for:
  - purchase and installation of fencing to keep livestock out of environmentally sensitive areas
  - installation of nest boxes and nesting platforms for wood ducks, osprey and other nesting birds
  - efforts to restore certain types of trees in woodland communities, e.g. regenerating an oak forest by planting oak seedlings, selective removal of competing vegetation, use of prescribed burns
  - brushland and grassland management practices that favor wildlife and complement the integrity of adjacent forests

  For information, contact the MN DNR Division of Forestry in St. Paul, MN, (612) 297-7298, or your local DNR forester.

Why choose a restoration cost-share program?

- Access to Funds and Technical Expertise
  Restoration cost-share programs allow you to improve the conservation value of your property with minimal out-of-pocket expense. The specialists who administer these programs can also offer important technical advice regarding proper engineering, construction methods, and site preparation practices that will help to assure the success and long-term stability of restoration projects.

- Projects with Narrow Purposes may have Broad Benefits
  It is important to note that a given project can serve more than one purpose. Establishment of grassland nesting cover for pheasants, for example, benefits not only pheasants but many other species of ground-nesting wildlife as well. Accordingly, a landowner interested generally in improving native grassland habitats may find his or her goals met by participating in a cost-share program such as the Pheasant Habitat Improvement Program. The same is true of many restoration cost-share programs: Wetland-oriented programs often fund upland projects, forestry programs may fund activities that promote wildlife diversity, and erosion-control programs may be used to fund prairie restoration. The upshot is this - look beyond the name of a cost-share program to see what specific restoration practices it funds.

Deed Restrictions

What is a deed restriction?
A deed restriction defines specific limits regarding allowable uses and development of a property. It is established by a landowner on a property's title, typically when the landowner is selling the land and wishes to exert some influence over its use, usually to benefit adjacent lands to which he or she intends to retain title. State law presently limits enforceability of deed restrictions to 30 years (with exceptions defined in MN Title Standard No. 91A). They are subject to interpretation and nullification by the courts and are most practical in situations where the original landowner or the landowner's heirs own adjacent land and are in a position to observe and enforce any violation. There are generally no tax benefits.

Why choose a deed restriction?
A deed restriction is an alternative when an easement is not an option. For properties that do not qualify for a conservation easement, a deed restriction can provide land with a degree of protection.

Mutual Covenants

What is a mutual covenant?
A mutual covenant is a type of deed restriction involving a legal agreement between two or more landowners in which the same set of restrictions govern the development and use

of all involved properties. Also subject to the 30-year rule, it must be periodically renewed by agreement of all properties. There are generally no tax benefits.

Why choose a mutual covenant?

- Peace in the Neighborhood and Profitability for Developers
  Mutual covenants may be initiated by neighbors who have a common goal of protecting a shared landscape feature or the open space values of their neighborhood. More commonly, they are inserted in the title to a parcel of land by a sub-division developer who makes participation in the mutual covenant a condition of sale to protect attributes (e.g., scenic beauty) that promote high land values and marketability.

Leases

What is a lease?

In this context, a lease is the rental of a given parcel of land to a conservation organization for its exclusive use. The lease is generally for a specified term and for a rental fee that may be at or below the market rate. The landowner land organization sign a written agreement that specified the term, payment schedule, any stipulations regarding use of the land, and guidelines regarding cancellation by either party.

Why choose a lease?

- An Opportunity to Promote Conservation while Receiving Income
  While not common, long-term leases can be a tool for landowners who need income from their land, are interested in protecting its natural features, and yet wish to retain title to the land. Such leases are of interest to conservation organizations when the land supports rare species or is critical to efforts underway by the organization on adjacent lands.

Management Agreements

What is a management agreement?

A management agreement is a legal contract between a landowner and a conservation organization in which the landowner agrees to follow specified land practices for the benefit of their land's natural features. The organization provides technical expertise and, in some cases, assistance with carrying out the recommended practices. Contracts are typically for a specified term, but may be canceled by either party with proper notice. It may or may not involve income for the landowner.

Why choose a management agreement?

These agreements are often used in efforts to protect large-scale natural features such as the watersheds of rivers. Landowners who participate make an important contribution to the health of the environment and thus, to their communities.

Land Donation

Donating Unrestricted Title To Land

Basically a "no-strings attached" transfer of ownership, the donation of property with an unrestricted title leaves the future use of the property to the discretion of the recipient. Because the title is unrestricted by an easement or other legal device, the landowner who makes such a donation to a qualified charitable organization may be eligible for a deduction on their income taxes equal to the full fair market value of the property. The recipient organization may be able to give you an indication of what it intends to do with the land upon receiving title. In the case of a land donation for a DNR Scientific and Natural Area, for example, you will be given legal assurances regarding the future use of the land. You may also outline your wishes in a letter of understanding with the organization. Donation of an unrestricted title, however, implies that you are granting the organization the right to make whatever decisions it considers appropriate regarding the future of the land.

Donation of Trade Lands

Donations of unrestricted title to land are sometimes made as part of so-called trade lands transactions with conservation organizations involving properties that do not necessarily warrant protection for conservation purposes. Highly developed commercial properties and suburban residential lots, for example, may have high market value but little or no conservation value. Such properties can still, however, serve conservation purposes when donated as trade lands with the understanding that the organization will sell the land to fund protection efforts on other lands of higher conservation value.

Donation of Restricted Title To Land

If you'd like the recipient of your donated land to be legally obligated to abide by your wishes regarding the land's future use and management, you can restrict the title through a perpetual conservation easement of deed restriction. In the case of an easement, this may be accomplished in one of two ways. A landowner may first donate an easement to one conservation organization, then donate the restricted land to another. Subject to tax law, both donations qualify the donor for a charitable contribution deduction on his or her income tax. Alternatively, as is commonly practiced in donations of land for designation as a unit of the state outdoor recreation system (such as Scientific and Natural Area), the land may be donated with the understanding that the state, upon receipt of the land, will immediately protect it with a perpetual conservation easement. In this case, the higher, unrestricted value of the property may be used for both the donor's charitable contribution deduction or income tax, and for matching by the Critical Habitat Match Fund. Alternatively, a landowner may elect to protect the land prior to donation by placing a deed restriction in its title.

Such deed restrictions do not qualify as a charitable deduction for income tax purposes, nor do they designate a guardian to monitor and enforce the restrictions, as is provided for in a conservation easement. Placing a deed restriction on a property's title prior to donating the land may also reduce the value of the donation, and accordingly, the amount the donor may claim as a charitable contribution deduction on his or her income tax.

Donation by Bequest
This is also referred to as donation "by device." One way to plan for your land's future protection is to donate land to a conservation organization in your will. It is important that you first contact the intended recipient of the land to be sure that they are able to accept the donation. This is also an opportunity to discuss any wishes you have regarding the land's future use. Of course, added protection is given to the land if you establish a conservation easement on the title prior to or current with the execution of your will.

Donation of land by bequest will not enable you to make use of income tax deduction for the donation, nor will it release you from any other obligations of ownership during your lifetime. It will, however, reduce the assessed value

Donating Undivided Partial Interest
It is possible to donate land in increments; that is, to donate partial interests in a property over a period of time until eventually full interest has been transferred. You could, for example, donate a 20 percent interest in a given property each year for a period of five years. At the end of the five-year period, full interest to the property will have been transferred. The up side of this method is that you'll retain use of the property until the final interest is transferred, and will have more tax years in which to take the associated charitable deductions. The downside of this gradual transfer of ownership, however, is that each partial interest is not valued at a rate equal to its percentage of the value of the property. Using our example, you might expect that each donation of a 20 percent interest in the property would be valued, for tax purposes, at 20 percent of the full market value of the total property. But since the use and control of the land by the recipient is somewhat limited until they have full title, these donations of partial interest are afforded less value in the eyes of the Internal Revenue Service. When all is said and done, the positive aspects may more than compensate for the negative. Consulting your tax counsel will be important here.

Land Donation with Reservation of Life Estate
When donating land to a conservation organization, you may opt to reserve what is called a life estate. This entitles the person or persons named as life estate holders (perhaps you, or your aging parents) to live out their lifetimes on the property, even though the land is held by the conservation organization.

Structuring your donation in this manner is different from a donation by bequest, in that you may claim the donation as a charitable contribution deduction on your income taxes during your lifetime. To calculate the value of such a donation, the IRS subtracts the value of the retained life estates (using actuarial tables to estimate the life expectancies of those named) from the land's current market value. Accordingly, the greater the age of the people named in the life estate, the higher the value of the donation and, therefore, the greater the amount the donor may claim as a charitable contribution deduction on his or her income tax. (Note: Landowners may also reserve a life estate when selling land to a conservation organization, in which case there would be no potential tax benefits unless the land were sold at less than fair market value.)

Life Income Gifts
The general term "life income gifts" is used to describe a variety of strategies by which an individual may receive regular income as a result of a donation of land or other assets to a nonprofit conservation organization or other charitable organization. Through such options as charitable gift annuities and charitable remainder unitrusts, the donated land is typically sold and the proceeds invested to generate funds from which payments may then made to you (the donor) and /or to other beneficiaries named by you. Payments may be made for a specified period of years or for life.

Not a land protection option per se, life income gifts are, perhaps, best viewed as a means by which a donor of land may receive income (a portion of which may be tax-free) and potential estate tax and income tax benefits, while at the same time providing important financial support to a conservation organization.

Life income gifts function best when the donated land is of highly appreciated market value. Highly appreciated commercial or residential properties that may be sold with an unrestricted title (see the section on Trade Lands discussed earlier) are, therefore, appropriate for donation as a life income gift. Land of significant conservation value may also be donated as a life income gift, although in some instances, it may be less suitable for this particular type of donation since an actions to protect the land (such as a conservation easement) would likely reduce its market value and thus, its capacity to generate funds from which the payments to beneficiaries are made. A conservation organization will evaluate potential land donations for income gifts on a case by case basis. If the land is of outstanding conservation value such that it warrants designation as a natural area or preserve, an organization may accept the donation as a life income gift, retain title, and identify alternative funding sources to cover the payments to the beneficiaries.

To establish a life income gift through a donation of land or other assets, you may wish to contact a conservation organization directly. Many conservation organizations offer their own suite of life income gifts, with established criteria and policies for each. Alternatively, you may also choose to establish a life income gift, such as a charitable remainder unitrust, with a bank or other financial institution, in which case you could designate a conservation organization to be the recipient of all or a portion of the assets that remain in the fund after all life income beneficiary payments have been made.

Selling Land to Conservation Buyers

Strategies
Using the following strategies, you can structure a sale to help make it possible for a conservation buyer to purchase your land.

- Grant of Rights of First Refusal
  If you'd like a conservation buyer to have "first dibs" at buying your land, you can grant the individual, organization or agency a right of first refusal. The conservation buyer would then be informed of any bona fide offer by another

interested party to buy the property and would have the right - generally within a short time period - to buy the property at whatever price was offered by the other party.

- Option to Buy
  If a conservation buyer is interested in purchasing your land but needs some time to muster the funding, you can offer the individual, organization or agency a long-term option on the land. In exchange for a generally minimal fee (the amount of which is negotiated), the conservation buyer is extended the right to buy the property for a given price within a specified period of time. No other buyer will be able to purchase the land during this period. The option fee is nonrefundable and is generally applied to the purchase price if the option is exercised.

- Installment Sales
  With an installment sale, you allow a conservation buyer to purchase your land by making a series of payments over time. This gives the buyer time to arrange financing. There may also be tax advantages to you as the seller by receiving the income over time rather than in a lump sum.

- Bargain Sale
  In a bargain sale, you sell your property at less than fair market value. This is beneficial to the buyer for obvious reasons, but it can also be beneficial for the seller. If the bargain sale is offered to a qualified nonprofit organization, the difference between the fair market value and the bargain sale price may qualify as a charitable donation to the organization, and thus, a tax deduction for the donor. Since the seller receives less income from the sale, he or she is subject to less capital gains tax; this, along with the charitable contribution deduction (if the seller's tax situation allows them to fully use such deductions), may actually result in greater financial benefit to the seller from a bargain sale than would have been received from a fair market value sale - with the added benefit of the land going to a conservation buyer.

Figure 2

	Appraised Value	Sale Price to Conservation Buyer	Potential Tax Deduction for Seller
A	$167,000	$120,000	$47,000
B	$578,000	$462,400	$115,600
C	$1,700,000	$1.530,000	$170,000
C	$580,000	$500,000	$80,000

Note: Figures represent actual bargain sales completed by The Trust for Public Land in the years 1993-1996.

- Resolving Timing and Financing Issues
  If you want to sell your land to a public conservation agency at the city, county, state or federal level, your first step will be to contact that agency directly. If the agency is interested in the land but is not able to attain authorization or financing for the

purchase within a time frame that meets your needs, you may wish to enlist the aid of the Trust for Public Land (TPL). This nonprofit organization specializes in the acquisition of land for resale to public agencies, focusing on those land opportunities that public agencies cannot promptly act upon. Other nonprofit conservation organizations, such as the Minnesota Land Trust and The Nature Conservancy, may also be helpful in devising interim strategies to meet a landowner's immediate financial requirements while a public agency is making the necessary arrangements for purchase.

Appendix C

Stewardship Strategies for Natural Communities

Stewardship Strategies for Natural Communities

The following is a list of strategies for maintaining or developing a desired community type. These are general guidelines, and provide a starting place for landscape management. Site-specific plans may need to be developed to the guide the management of specific natural areas, especially on sites where the natural communities are of high quality or are part of an extensive natural area.

Forest Communities

Generally, to maintain a forest the best approach is one that encourages regeneration and favors the establishment of a canopy that is structurally diverse and species rich. This may be as simple as controlling non-native shrubs, minimizing disturbances, and allowing any existing seed bank to germinate. Mesic oak forests may tend to become more like a Maple-Basswood in the complete absence of fire, so, if desired, selective thinning to encourage oaks may allow oak forest to perpetuate. Specific forest management strategies include:

- Control Invasives: Control European buckthorn, Tartarian honeysuckle, and other invasive shrubs by cutting and immediate herbicide application (see fact sheets for control of specific species). Sites should be monitored for reinfestation by these species, after control efforts are instigated. On occasion, native species may also act "invasively" and some control may be appropriate. Ironwood, especially, may form dense stands that shade out other species. Girdling will kill individual trees, and leave standing snags for wildlife.
- Revegetation: As invasive species are controlled, monitor for the recruitment of native shrub and forb species from adjacent areas or from the seed bank. If natural recruitment is not adequate or is unlikely, due to a lack of a source, actively planting appropriate species from a local ecotype source may be required.
- Reduce Edge: Reduce or eliminate the creation of new "edge" by eliminating roads through the interior and siting trails in such a way that canopy species are not disturbed, as well as limiting the width of trails. In areas where two woodlots are separated by a clearing or trail, allow the forest to colonize the area, either via natural encroachment or by actively replanting the site. At construction sites, place the home and yard in front of a woodlot rather than inside it, and use native tree and shrub species for landscape plantings. Homeowners can help significantly by controlling buckthorn and other invasive species at the junction between lawn and woods, as well as within their woods, and planting the edge area with native shrubs and trees to provide competition for non-native species.
- Buffer Strips: Leave a wide strip of uncultivated land adjacent to wooded slopes to slow the runoff rates and reduce erosion. Prairie grasses are an excellent choice for planting in such areas. Once established, clumps of native grass slow the rate of surface runoff and their deep (3' – 15'), fibrous root systems help water infiltrate while effectively holding the soil. Woody species and non-native pasture grasses are not nearly as effective for erosion control. Local ecotype seed should be used for any plantings.

- Oak Wilt: Control oak wilt using methods recommended by the Minnesota DNR Division of Forestry. Oak trees should not be cut, pruned, or injured between April 15 and July 1 of each year. Exposed roots injured by construction activities or grazing are just as likely to result in oak wilt infection as cut branches. If injury occurs, the wound should be treated with a tree wound dressing within 15 minutes or less to reduce the infection potential. A vibratory plow should be used to sever roots along the edge of any construction area prior to beginning work, to prevent the transfer of oak wilt fungus from exposed roots and allow for regeneration at the point of cutting. Tree protection zones should be fenced to prevent entry or compaction by construction equipment. Dirt and materials should not be stored in these areas.

Woodland and Savanna Communities

Site management for woodlands and savannas can take several directions. One approach allows natural succession to proceed, and where conditions are appropriate the site will evolve—woodland into forest, savanna into woodland. Another strategy maintains the current habitat, whereas the third approach, for woodlands, sets succession back, and converts the site into a savanna. Some suggestions for determining which community type is appropriate are discussed below, followed by information on managing oak woodland and oak savanna; for more information on managing for oak forest, review the oak forest stewardship sheet.

Selecting a community to manage for:

In sites characterized by large-crowned, spreading bur oak in the canopy, a dense subcanopy of 1 or 2 species and little to no regeneration of tree species in the understory, management as either woodland or savanna is appropriate. If prairie species appear to be widespread through the site, or if the shade cast by the understory layer is not overly dense and thus residual prairie species or prairie seed bank may be present, a savanna restoration is indicated. A savanna may also be most appropriate for sites that are already savanna-like in character, and need only to have the ground layer restored to prairie species, or where the more open character of a savanna is desired.

Where the subcanopy and understory layers contain a good diversity of tree species with potential to become canopy specimens (sugar maple, oaks, basswood, American elm) as well as a diverse layer of subcanopy species (green ash, walnut, bitternut hickory, american elm), management for a forest may be most appropriate. These are sites that already have some of the composition necessary to become a forest over the next 50 – 100 years. Forest management may also be appropriate on woodlands that are the result of logging or grazing activities and historically were probably forest. These generally will occur on a somewhat sheltered site, and may be immediately adjacent to forested stands. At these sites, follow the management strategies described under "Forest Communities."

Management for Oak Woodland and Oak Savanna

Consider the following steps:

- Restore Community Structure and Control Invasive Species: eliminate understory trees and invasive shrubs: Understory trees such as ironwood, maple, aspen, or birch should be killed by girdling, to reduce stump sprouts; they may be left standing, for wildlife habitat, or removed Cut and remove Eastern Red Cedar. Control invasive shrub species by cutting and immediate herbicide application (see Fact Sheets for control of specific species). In areas where the canopy is relatively close and oaks may be injured during the removal of other species, use practices that limit the spread of oak wilt.
- Use Prescribed burn as necessary: Prescribed burns can eliminate cool season grasses and invasive shrubs, and prepare the site for prairie establishment. If a prescribed burn is planned, do not leave woody debris left over from clearing, such as snags, dense brush piles, or red cedar on site, as they can significantly increase fire temperature and contribute to fatal crown fires in the bur oak.
- Revegetation: Once invasive shrubs are under control, monitor for the recruitment of native shrub and forb species from adjacent areas and from the soil seed bank. Several years may be necessary for natural recruitment efforts to become apparent. If, as is likely, exotic species begin to encroach onto the site, planting with native species will speed up the rate of revegetation, and provide competition for non-natives. Local ecotype plant material should be used.
- Maintenance: Since woodland and savanna communities were historically maintained by fire, prescribed burns every 3-8 years will help to reduce invasion by non-native species and mesic forest species. If this is not feasible, hand-control of invasive woody species is required, with periodic mowing of prairie openings and savanna.
- Reduce edge: Although the edge effect is somewhat less pronounced in woodland communities than in forest communities, since the light and moisture regime are not affected so drastically, reducing the amount of edge still allows for better migration of small animals, better plant colonization and dispersal, and helps to buffer the community from disturbances. To reduce edge, minimize the number of roads through a site and keep trails narrow. In areas where two sites are separated by a clearing or trail, allow the target community to colonize the area, either by natural encroachment or by active management. These communities can be attractive home sites, and the home and yard should be situated at the edge or front of the site, rather than inside it. Homeowners can help by controlling buckthorn and other invasive species at the junction of their lawn and the woodland, and by using native shrubs, trees, forbs, and grasses in their landscape plantings. Again, local ecotype plant material should be used wherever possible.
- Oak Wilt: Control oak wilt using methods recommended by the Minnesota DNR Division of Forestry. Oak tress should not be cut, pruned, or injured between April 15 and July 1 of each year. Exposed roots injured by construction activities or grazing are just as likely to result in oak wilt infection as cut branches. If injury occurs, the wound should be treated with a tree wound dressing within 15 minutes or less to reduce the infection potential. A vibratory plow should be used to sever roots along the edge of any construction area prior to beginning work, to prevent the transfer of oak wilt fungus from exposed roots and allow for regeneration at the point

of cutting. Tree protection zones should be fenced to prevent entry or compaction by construction equipment. Dirt and materials should not be stored in these areas.

Wetland Communities

The goals of wetland management are often diverse, ranging from improving groundwater quality and managing stormwater runoff, to providing better wildlife habitat and improving the condition of the site. Generally, the latter two goals can be achieved with initiatives similar to those implemented at other community types; namely, controlling exotic species, (re)establishing appropriate species, and mimicking the natural disturbance regime. Before any active restoration efforts begin, the end-goal should be clearly specified. In general:

- Grazing: Grazing activities should be reduced or eliminated. Where wetlands exist in pastures, wetland perimeters and a buffer zone should be fenced to prevent traffic in the wetland. If the site is grazed, activity should occur late in the season (mid-August – fall) when soils are dry; this timing also allows native graminoids and forbs to mature and set seed. One exception is sites with heavy infestations of reed canary grass, as anecdotal evidence suggests that moderate grazing may help control it and allow native species to persist in the ground layer. Grazing alone will not eliminate reed canary grass, however.
- Control Invasive Species:
  - Purple Loosestrife: This aggressive exotic produces abundant seed and can resprout vigorously from root and stem fragments, factors that make control difficult once it is established on a site. Small infestations can be controlled by hand-pulling; care should be taken to remove as much of the root as possible, to prevent resprouting. Cutting is not effective. Wetland-safe herbicides containing glyphosphate, such as Rodeo and Pondmaster, can be used effectively on larger stands; a permit is required to apply pesticides in certain wetland situations. For more complete information on timing and methodology, see the Purple Loosestrife Fact Sheet in Appendix .
  - Reed Canary Grass and Giant Reed Grass: Like purple loosestrife, reed canary grass produces abundant seed and reproduces aggressively from stem shoots and root fragments. Small stands can be treated with wetland-safe herbicide such as Pondmaster or Rodeo; a permit is required to apply herbicides in certain wetland situations. Control of large stands is generally not possible unless an extensive, full-scale restoration is planned and significant investments of time and money are possible. As reed canary grass responds aggressively to disturbance, limiting disturbance at a site, especially repeated fluctuations in water levels, can help prevent its establishment and proliferation. While not as aggressive as reed canary grass, giant reed grass also competes aggressively. Measures used to limit reed canary grass can be used on giant reed grass as well.
- Restore Normal Hydrology: removing, blocking, or breaking ditches and drain tiles that drain wetlands and that drain into wetlands can help to restore normal hydrology. Establishing buffer zones planted with native vegetation slows the rate of runoff into wetlands, and allows more runoff to infiltrate into the groundwater. If the wetland receives groundwater recharge, this infiltration filters runoff before it seeps into the wetland, and also distributes the input over a larger time span.

- Reduce Nutrient-Inputs and Sedimentation: Use wide buffer strips planted with deep-rooted, native prairie vegetation around agricultural fields and pastures to slow the rate of run-off and increase infiltration before surface water encounters wetlands. Avoid over-grazing fields, as stands of vegetation slow runoff rates. Homeowners should be educated about appropriate timing and application rates of fertilizers, as residential use can contribute significant amounts of nutrients to a system.

Prairie Communities

Generally, to maintain a prairie community, a management strategy should mimic the natural disturbance regime for the habitat. Ideally, this will remove accumulated plant material and encroaching woody species, as well as reduce or eliminate grass and forb species that are not prairie natives. In some situations, it may be necessary to decide if a prairie community is desired, or a brush-prairie or savanna community, where prairie species form the ground layer beneath an open canopy of willow, brush, or scattered oak or aspen.

- Remove Invasive Species: Cut and remove Eastern Red Cedar, Siberian Elm, sumac species, and other woody plants that are not a natural component of prairie communities. Some species may require an herbicide application to the stumps, as described in the Fact Sheets (see Appendix D). Additional spot-spraying with herbicide may be necessary to control populations of aggressive weeds such as spotted knap-weed.
- Use Prescribed Burn as Necessary: Properly used, prescribed burns can eliminate cool season grasses and invasive shrubs, and help maintain a prairie community. If a prescribed burn is planned, clear woody debris from the site. Snags and brush piles can significantly increase the temperature of a burn, and contribute to fatal crown fires in bur oak and raise soil temperatures high enough to destroy dormant seed, including prairie seed. If burns are not possible due to topography, homes, or for other reasons, spring mowings can mimic the effects of burning to some extent.
- Revegetation: Once invasive species have been removed, monitor for the recruitment and establishment of prairie species from existing populations and the seed bank. To help provide competition for weedy species, native seed can be collected from the site and either sown directly, or given to a reputable nursery to grow plugs to plant on-site. If off-site seed is used, local ecotype should be used as much as possible. On high-quality sites, it is especially important to allow on-site recruitment and minimize the introduction of seed from off-site; in these cases, the source of off-site seed needs to be carefully considered.
- Maintenance: Since prairie communities were historically maintained by fire, prescribed burns every year for the first few years and every 2 – 4 years thereafter will help to maintain the prairie. If burns are not possible, mowings may be substituted. Regardless of the strategy used, the site should be divided into several sections, with at least 1 section unmowed/unburned each year. This provides a refuge for animals and insects during the burn, and allows different microhabitats to develop within the community. Dry prairie sites may require less frequent burning.

- Grazing: Use grazing practices that enhance native plant establishment and targets cool season grasses, by grazing sites early in the season (May-June), when Kentucky bluegrass and brome are actively growing and prairie species are relatively inactive.
- Reduce Fragmentation: Small, isolated stands are more vulnerable to disturbance than is a single community with similar area, as weedy species encroachment is more aggressive around an edge than in the interior, a larger area is likely to support more species and thus be more adaptable to changing environmental conditions, and it provides a better propagule source for revegetation of disrupted areas within its boundaries. A single disturbance event is also likely to affect a smaller percent of the total area of a large site, as compared to a smaller site. Reducing the amount of edge also allows for better migration of small animals and better plant colonization and dispersal. To reduce edge, reduce the number of trails and roads through a site and keep trails narrow.
- Control Herbicide Drift: Prairies may be especially susceptible to herbicide drift, and herbicide application on adjacent fields should be performed in such a manner to eliminate drift onto prairie remnants. Herbicide should be applied on calm days, or, if there is a light breeze, it should blow herbicide away from the prairie rather than into it. Narrow bands of evergreens between prairies and fields may help shield the remnants from drift, and land managers may want to consider leaving such evergreen shelterbelts in place. Evidence for such an effect is anecdotal.
- Homeowners: Where private homes occur on prairie remnants, homeowners can help by reducing the size of their yard, reducing and eliminating use of herbicides, pesticides, and fertilizers, and landscaping with local ecotype native prairie species. In addition, the management recommendations listed here should be applied.

Appendix D

Exotic Species Fact Sheet

Exotic Species Fact Sheets

The Truth About Exotic Species
1. European Buckthorn
2. Exotic Honeysuckles
3. Siberian Elm
4. Staghorn and Smooth Sumac
5. Black Locust

Minnesota Department of Natural Resources

The Truth About Exotic Species

The terms "exotic," "alien" "pest plant," "problem species," and "weed" have been used for plants from other continents or distant parts of a large country which disrupt native plant communities. Not all non-native plants become problems, but too often plants out of their natural range crowd out natives.

You can help control known exotic threats and avoid introducing new threats by understanding the problem:

What characteristics make exotic species a problem?

High productivity. More seeds mean more seedlings. Purple loosestrife and sweet clovers produce hundreds of thousands of seeds or more, per plant. By prolific seed production they quickly establish in disturbed areas, crown or shade out other plants, gradually spreading into less disturbed areas.

Seed dispersal. Exotics whose seeds easily get around tend to quickly surround. Buckthorn and honeysuckle berries are eaten by birds, which deposit undigested seeds everywhere on the fly. Tiny Siberian elm seeds ride the wind far and wide.

Growth period or seasonal advantages. When sunlight and soil conditions are right for growth, exotics will grow, even if the season is shifted from their home and the local natives aren't growing. European buckthorn, when planted in North America, leafs out early in the spring and stays green long after most deciduous trees turn color and drop leaves. Buckthorn's longer growing season means faster growth to maturity, an advantage over native shrubs.

Lack of natural controls. Insects and plant diseases seldom travel to new habitats with their exotic host.

How do plants move from their natural range to new, distant places?
Accidentally and when well intentioned people move them. Eurasian watermilfoil seeds and plant parts traveled from Europe to the eastern U.S. coast in ship ballast, then spread to the Midwest by waterbirds and boats. Horticulturists promoted European buckthorn for easily managed hedges. Exotic modes of travel: Ship ballast/boat bilge - Boat propellers -Bird ingestion - Floodwaters - Nursery sales - Contaminated fill soil - With agricultural seed.

Who's problem is it? Exotic plant control costs millions of dollars each year. Herbicides, labor, and research top the bill in the fight against plants which threaten to clog waterways, ruin fisheries, turn pasture to wasteland, compete with agricultural crops, shade out forest regeneration and overrun natural areas.

How to stop exotics: Get to know the common exotic threats listed top, left. Inform friends and neighbors. If you see these offered for sale, explain the problem to your nursery, grower or supplier. If you find any on your property, consult the information sources listed or contact a resource professional for control methods.

Some exotics to watch out for

European buckthorn, *Rhamnus cathartica*
Exotic Bush honeysuckles, *Lonicera* sp.-*Morrowi, tatarica, japonica*
Siberian elm, *Ulmus pumila*
Black locust, *Robinia pseudoacacia*
Staghorn and Smooth Sumac, *Rhus typhina* and *R. glabra*
Leafy spurge, *Euphorbia esula*
Garlic mustard, *Alliaria officinalis*
Crown vetch, *Coronilla varia*
Purple loosestrife, *Lythrum salicaria*
Knapweeds, *Centaurea* sp.
Birdsfoot trefoil, *Lotus corniculatus*
Sweet clovers, *Melilotus*, sp.
Wild carrot (Queen Anne's lace), *Dauscus carota*

Information Sources

DNR Information Center

Good text: Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants, Bureau of Endangered Resources, Wisconsin DNR, PO Box 7921, Madison, WI 53707-7921. Phone: (608) 267-5066. E-mail: kearns@dnr.state.wi.us

Web Site: Native Plant Conservation Initiative. Alien Plants Working Group exotic fact sheets on the web at http://www.nps.gov/plants/alien

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DNR Information Center E-mail: info@dnr.state.mn.us

Http://www.dnr.state.mn.us/fish and wildlife/exotics/index.html

FACT SHEET #1

European (Common) Buckthorn *Rhamnus cathartica*

Description:

Shrub or small tree reaching height of 25' (7.6m), trunk diameter up to 10" (25cm), crown spreading and irregular; bark gray to brown, rough textured when mature and often confused with *Prunus sp.* Inner bark yellow. Twigs often tipped with a spine. Small black fruits up to 1/4" (0.6cm) diameter containing 3-4 seeds typical. Leaves broadly elliptic, rounded to pointed at the tip, and toothed. Upper and lower leaf surfaces smooth. Upper leaf surface dark glossy green. Leaves stay green late into fall, after all other leaves have fallen.

Concern:

Endemic to Eurasia, *R. cathartica* was introduced to North America as an ornamental shrub. It is native to Eurasia. The fruit causes a severe laxative effect, readily distributing its seeds when eaten by birds. Common buckthorn invades mainly woodlands and savannahs, although it may also be found in prairies and open fields. Once established, it crowds or shades out native shrubs and herbs, often completely obliterating them. MN Interagency Exotic Species Task Force 1991 future threat ranking of SEVERE, current threat SEVERE

K. E. Bolin

European Buckthorn, *Rhamnus cathartica* leaves and mature berries

Controls:

Late March to Early May: Prescribed fire is one method proposed for controlling buckthorn in natural areas. In the upper Midwest, burns conducted as soon as leaf litter is dry should lower resprouting vigor, due to low carbohydrate levels. Burning every year or every other year in established stands may be required for 5-6 years or more. Unfortunately buckthorn seedings often occur in areas with little litter to carry a fire more often than once every 3-4 years. Fire will top kill a mature plant, but resprouting does occur. Buckthorn seedlings appear to be very vulnerable to fire, perhaps due to their poorly established root structure. Uprooting of smaller seedlings with a weed wrench is another non-chemical control.

May to October: McHenry County, IL Conservation District (MCICD) reports excellent results using 20% **Garlon 3A (Trichlopyr)** in water with dye on cut stumps during the growing season. Product label suggests avoiding the spring sap flow. **Garlon 3A** undiluted applied to cut stumps between first budding in May, through summer, to hard freeze in fall was 95% effective in preventing resprouting (Boudreau and Willson)

Mid-August to October: MN DNR Region V State Parks Resource Management has been using a fall cut with immediate stump application of a 5:1 water:**Roundup (Glyphosate)** solution using a hand sprayer. Initial checks indicate a >85% control overall. Kline, 1983 in Wisconsin, used a 5:1 water Roundup solution on cut stumps in August/September with 100% control.

Winter: 20% **Garlon 4** with an oil, such as Penevator, and dye on cut stumps was reported as effective by MCICD. Frill application is also effective. Experiments at the University of Wisconsin Arboretum report good results using a 12.5% solution on cut stumps, or a 6% solution basal bark treatment to stems < 3 inches dbh.

This information is not an endorsement of particular products or practices. Pesticide use must follow label directions and applicable state and federal laws.

Minnesota Department
of Natural Resources
Region V (507)285-7432

Sources on file with MN DNR Region V State Parks Resource Manager:
TNC Element Stewardship Abstract for R. cathartica and R. frangula
Illinois Nature Preserves Commission Vegetation Management Guideline on Exotic Buckthorns
Buckthorn Reasearch and Control at Pipestone National Monument, D. Boudreau & G. Willson, authors

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FACT SHEET #2

Exotic Honeysuckles *Lonicera tartarica, L. x bella, L. maackii, L. morrowii*

Description:

Upright deciduous shrubs; reaching heights to 20'; leaves opposite, entire. Flowers in May or June. Tartarian honeysuckle has generally pink flowers but may vary from white to red; Amur and Morrow's flower white, yellow with age. The hybrid of Tartarian and Morrow's has characteristics of both parents. Fruits red or yellow in pairs in the axils of the leaves. Careful identification of honeysuckle species is necessary before attempting control measures. In the *Manual of Vascular Plants of Northeastern United States and Canada*, Gleason and Cronquist note that native bush honeysuckles have smooth flower styles (narrow area of pistil above ovary); styles hairy in exotics. In the northern half of Minnesota, native bush or shrub honeysuckles are *L. villosa*, and *L. oblongifolia* (found in swamps, wet woods and bogs), and *L. canadensis*. Native climbing or twining forms are *L. dioica* (statewide), *L. Sempervirens* and *L. hirstuta* in the south, and *L. prolifera* in far southeast MN only.

K E Bolin

Honeysuckle, *Lonicera species*, probably *L. tartarica*

Concern:

Endemic to Russia, Asia and Western Europe, bush honeysuckles were introduced to North America as ornamental shrubs and used as wildlife habitat. Commercial propagation continues with many cultivars of bush honeysuckles available. Abundant fruits are readily eaten by birds and thereby widely dispersed. As a group, the bush honeysuckles tolerate a variety of moisture regimes and habitats. Seedlings establish in disturbed or sparsely vegetated areas. Honeysuckles out-compete native plants because of earlier leaf expansion and later fall retention; research has also suggested alleopathic effects, inhibiting the growth of other plants. MN Interagency Exotic Species Task Force 1991 current threat ranking for Tartarian honeysuckle is SEVERE, future ranking of SEVERE.

Control:

March to May: Prescribed burning in fire adapted communities will kill seedlings and top kill mature plants, repeated fire may be necessary for adequate control. (INPC guideline)

August to October: Application of a 5:1 water:**Roundup (glyphosate)** solution by hand sprayer to cut stumps has been used successfully by MN DNR Region 5 Resource Management. Cut stumps as low as possible for better herbicide application surface. Honeysuckle's tough wood and cutting low to the ground, where there is more grit in the bark, often require frequent sharpening of tools. A 4:1 solution, applied as above, is also noted in INPC guidelines and TNC ESA as the preferred control method. Untreated cut plants readily resprout; pulled plants propagate from broken roots.

Minnesota Department
of Natural Resources
Region V (507)285-7432

Sources on file with MN DNR Region V State Parks Resource Manager-
TNC Element Stewardship Abstract for L. tatarica, L. morrowii, L. x bella
Illinois Nature Preserves Commission Vegetation Mgmt. Guideline on Bush Honeysuckles(INPC)

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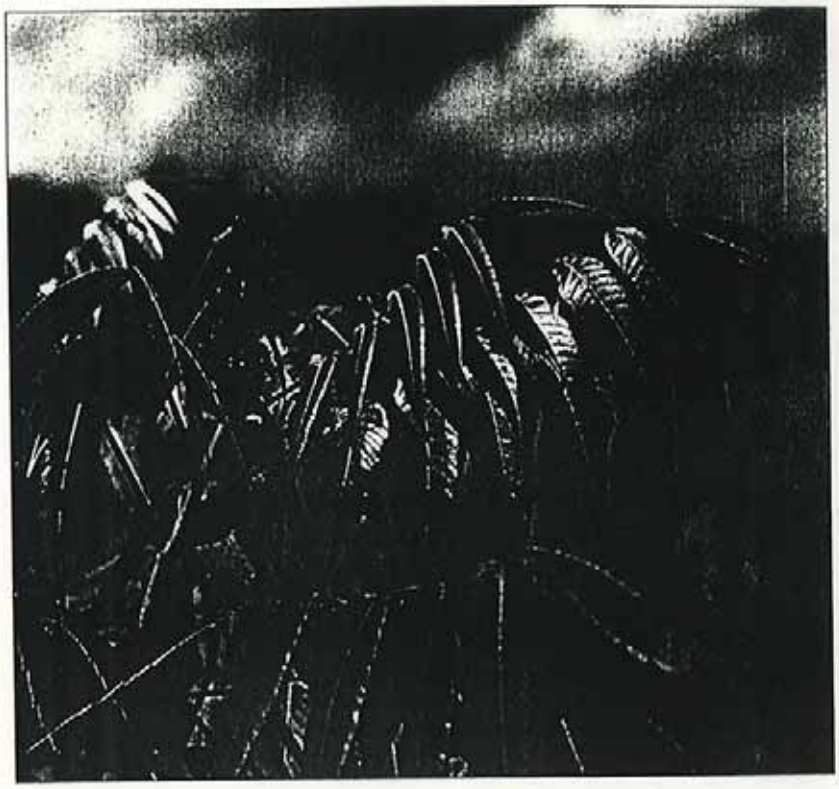
FACT SHEET #3

Staghorn and Smooth Sumac *Rhus typhina* and *R. glabra*

Description:

Staghorn sumac is a shrub or occasionally a small tree, height to 32' (10m), bark smooth and gray, twigs velvety-hairy; leaves odd-pinnate; leaflets oblong lanceolate and serrate; flower in terminal panicles appearing in June, fruit drupe more or less spherical, thickly covered with crimson hairs. Wood soft and greenish yellow. Smooth sumac is similar to the above species except that twigs are glabrous (without hairs) and somewhat glaucous (covered with a fine, waxy, removable powder imparting a whitish cast to surface).



Smooth sumac, *Rhus glabra*, leaves and fruit

Concern:

Staghorn and smooth sumac are native to North America. Sumacs generally grow in dry, rocky or gravelly soil. Sumac is also tolerant of other well drained conditions and well adapted to conditions on bluff prairies and dry prairie sites, growing in the open and in transition areas between woods and prairie. Plants spread profusely by suckering, forming dense, low islands of cover. Sumac clusters readily cover other prairie vegetation, especially in the absence of periodic fire. Although fire or repeated cutting stimulate new growth, nutrient stores are eventually depleted. Considering the small acreage of native prairie remaining, uncontrolled sumac spread imperils the community.

Control:

March to May: Prescribed burning in fire adapted communities will kill seedlings and top kill mature plants; periodic fire combined with cutting (described below) should control spread of sumac species. Some research (TNC; INPC) guidelines showed more vigorous growth with spring burns; August burns were suggested for areas not in a cutting regime.

Late May to Early July: Sumac should be **cut** with loppers, or swede saws for large plants, as low to the ground as possible to avoid resprouting and safety hazards. In areas of heavy sumac cover, where underlying vegetation would be damaged by dropped cuttings, remove and stack in a less sensitive area for later burning.

Late July through August: Return to early summer site to cut resprouts, further depleting the energy stores of the plants and deterring growth in the next season.

MN DNR Region V State Parks Resource Management has found that after 3-5 years of cutting twice a year, an occasional prescribed fire and/or cutting controls sumac cover on bluff prairies.

Minnesota Department
of Natural Resources
Region V (507)285-7432

Sources on file with MN DNR Region V State Parks Resource Manager-
TNC Element Stewardship Abstract (TNC) for Rhus glabra
Illinois Nature Preserves Commission (INPC) Vegetation Management Guideline Rhus glabra

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PROBLEM SPECIES FACT SHEET #4

Siberian Elm *Ulmus pumilla*

Description:

Siberian elm is distinguished by small, elliptic, smooth above, toothed leaves, nearly even at the base, 0.8-2.6" (2-7cm) long. Alternate simple leaves short pointed at the tip and tapering or rounded at asymmetrical base; dark green above, paler and nearly hairless beneath. Mature height 50-70', round crown of slender, spreading branches; rough bark gray or brown and shallowly furrowed at maturity; nearly hairless twigs and small, blunt buds. Flowers greenish, lack petals, occurring in small drooping clusters of 2-5. Fruit one-seeded, smooth, circular, 0.4-0.6" (10-15mm) wide, in clusters.

K. E. Bolin

Siberian elm *Ulmus pumilla*

Concern:

A native of northern China, eastern Siberia, Manchuria and Korea, Siberian elm was introduced to the U.S. in the 1860's for its hardiness and fast growth in a variety of moisture regimes and habitats, including droughts and cold winters. Seeds are produced early in spring and spread by the wind. Germination rate is high and seedlings soon establish in the bare ground found early in the growing season. Near a seed source seedling thickets quickly crowd out and dominate native vegetation, especially in disturbed or sparsely vegetated areas. MN Interagency Exotic Species Task Force 1991 current threat ranking of MODERATE, future threat ranking of SEVERE.

Control:

March-May: A regular regime of **prescribed burning** in fire adapted communities will kill seedlings. Removal of on site seed sources by other methods is necessary for adequate control.

Mid-May to July: Trees girdled in mid-May to early July will die over 1-2 years without sprouting if cut properly. Cut through the bark slightly deeper than the cambium in two parallel cuts 3-4 inches apart, then knock bark off with a blunt object such as the back of an axe head or dull end of a girdling bar. The xylem must remain intact; if girdled too deeply the tree will respond as if cut down, i.e. it will resprout.

April to September: During the growing season, seedlings can be hand pulled and small trees carefully removed by a grub hoe or weed wrench. Although labor intensive, large trees can be cut down and resprouts trimmed as needed.

April to September- After spring sap flow and through the growing season, a cut stump application of water : **Roundup (glyphosate)** solution between 9:1(10%) and 4:1(20%) concentration by hand sprayer is effective. MN DNR State Parks Region V Resource Management used a 4:1 Roundup solution with good results.

Sources on file with MN DNR Region V State Parks Resource Manager -
Illinois Nature Preserves Commission Vegetation Management Guideline on Siberian Elm
Check out the Exotic species control web site: http://www.aqd.nps.gov/natnet/hpci

MN DNR Region V State Parks
Resource Specialist (507)280-5059.
e-mail: kathy.bolin@dnr.state.mn.us

FACT SHEET #5

Black Locust *Robinia pseudoacacia*

Description:

Black locust is a fast growing tree, height 40-100' (12-30m); mature trees have furrowed dark brown bark with flat-topped ridges, seedlings and sprouts have long thorns and grow rapidly. Leaves alternate, pinnately compound, 7-21 elliptic or rounded leaflets, dark green above, pale beneath. Fragrant white flowers appearing in May or June have a yellow blotch on the uppermost petal, and appear in drooping racemes. Fruit pods are smooth, 2-4" (5-10cm) long, containing 4-8 seeds.

K.E. Bolin

Black locust, *Robinia pseudoacacia*, in flower

Concern:

Black locust is native to the southeastern United States on the lower slopes of the Appalachian Mountains, with outliers north along the slopes and forest edges of southern Illinois, Indiana, and Missouri. This tree has been planted extensively for it's nitrogen fixing abilities, to provide nectar for honey bees, hardwood lumber, erosion control and as fence posts. It is commonly found in disturbed areas such as old fields, degraded woods, and roadsides. The trees prefer sites with full sun and little competition. Black locust reproduces vigorously by root suckering and stump sprouting to form groves of trees interconnected by a common fibrous root system. Physical damage to roots and stems increases suckering and sprouting, making control difficult. Once established, black locust crowds out native vegetation in prairies, upland forests and oak savannahs. MN Interagency Exotic Species Task Force 1991 current threat ranking of MODERATE, future threat ranking of SEVERE.

Control:

Mid-June to August: Hand application of 6.25% **Roundup (glyphosate)** solution (15:1 water:Roundup) to cut stumps has been used by MN DNR Region V State Parks Resource Management. Resprouting and suckering from dense clones may require follow up treatment after a few years*. Literature also describes good to excellent success at this concentration.

Year-round: A 25% **Garlon 4** solution in basal oil applied with backpack sprayers has been used on cut stumps by the Scientific and Natural Areas Program in Minnesota. Thoroughly wet the cut stump and bark below the cut, down to the root collar, but avoid runoff.

*Apparently killed plants can resprout several years after most all treatments, requiring annual or every other year monitoring.

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Sources on file with MN DNR Region V State Parks Resource Manager-
TNC Element Stewardship Abstract for *Robinia pseudoacacia*
Illinois Nature Preserves Commission Vegetation Management Guideline on Black Locust

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Appendix E

Best Management Practices (BMP's)

Best Management Practices (BMP's)

1. Developing Shoreland Landscapes and Construction Activities
2. Stabilizing Your Shoreland to Prevent Erosion
3. Minimizing Runoff from Shoreland Property
4. Caring for Shoreland Lawns and Gardens

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UNIVERSITY OF MINNESOTA
Extension
SERVICE

PROTECTING our waters

Developing Shoreland Landscapes and Construction Activities

SHORELAND BEST MANAGEMENT PRACTICES

NUMBER 6 IN THE SERIES

What Are Shoreland BMPs?

Best Management Practices (BMPs) are actions you can take to reduce your impact on the environment. BMPs have been described for agriculture, forest management, and construction. This fact sheet describes BMPs you can adopt on your shoreland property to help protect and preserve water quality. In many cases, the best management for shorelands may be retaining the natural characteristics of your property.

Why Is a Landscape Plan Necessary?

Whether you are landscaping your property, building a cabin, or designing a large resort, each land parcel has limitations for development. Limitations may include the type of soil, steep slopes, native vegetation, and other landscape features.

Plants and trees help to hold the soil and prevent erosion, especially on steep slopes. Removing them to establish a lawn increases the chance for soil erosion. Soil erosion can lead to structural damage, reduce soil fertility, and fill in road ditches. It harms your river or lake by causing excess sedimentation, killing aquatic bottom life, and disrupting spawning. The sediment, with accompanying nutrients, may lead to algal blooms, decreased lake depth, and reduced aesthetic appeal. All of these potential problems are expensive to correct and, more importantly, can be avoided by proper water and landuse practices.

Use existing features of your landscape in creating your plan. You can prevent problems by working "with the land" rather than against it.

Getting Started

The most important steps in getting started are to draw a detailed map of your property (see Figure 1 as an example) **and** to check with your planning and zoning office for local requirements. On the map, take care to accurately note these important features:

- hills and sloping areas
- location of roads and driveways
- potential building sites
- drainage patterns
- sewage treatment systems
- existing vegetation
- wildlife habitat
- land features such as wetlands and rock outcrops
- water wells

Next consider your long-term objectives for the property:

- How long do you plan on owning the property?
- What space do you require for your outdoor recreation activities?
- Do you want to create additional wildlife habitat?
- How compatible are your ideas with the expected long-term development objectives of the area?
- Do you plan on expanding or remodeling in the future?
- Does the "lay of the land" suit your ideas?

These and many more questions should be explored, including considering the potential uses for your property.

Produced by the Arrowhead Water Quality Team, a cooperative effort of Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis counties and state and federal agencies. All publicly funded agencies involved are committed to equal opportunity education, service, and employment.

Developing Your Site Plan

The site plan should be based on your long-term objectives and the suitability of the land for these uses, with precautions taken to prevent soil erosion and water pollution. With these considerations in mind, your site plan will optimize the natural beauty and attributes of your property. The site plan can be a one year, ten year, or a twenty-five year plan, depending on your resources and time. But remember, the longer you wait, the more difficult and costly it will become to fix erosion problems.

Layout of Your Grounds

If you have the freedom to arrange your buildings and grounds, you can reduce water runoff problems in several ways. Locate driveways, walks, and yard and garden edges to follow level contours and gentle slopes. Do not lead water directly downhill. This gives it maximum speed and cutting power for erosion. Long, steep slopes have the greatest erosion potential. Consider putting small dams at intervals in ditches to slow runoff water and trap sediment. Cross-slope designs are better than up-and-down-hill ones.

The site plan you develop is critical. Site your septic system and water well in suitable areas before you finalize building locations and landscaping plans.

General Guidelines for Landscaping

- **Keep the site covered.** Any disturbance of ground cover (grass or shrubs) will expose soil. This leads to erosion and slope failure. Use hay or straw as a mulch to cover disturbed areas after reseeding. A good rule of thumb is one 50-pound bale per 500 square feet. Consider working only in a small area and stabilizing that site before disturbing another.
- **Minimize disturbance to plants and trees.** Select and save trees to gain time in landscaping later. Protect trees from heavy equipment by encasing them with heavy planks tied vertically around the trunks. Large trees, especially birch, can be killed by heavy traffic that compacts the soil. Putting fill material too deeply over the root area can also kill trees.
- **Maintain a filter strip of natural vegetation along the banks of lakes and streams.** The best filter strip is mature woodland with undisturbed grass and shrub layers.
- **Establish permanent cover.** After your grounds have been graded to minimize and control runoff, the next step is to plant a permanent cover on all areas that have been disturbed. Trees and shrubs are excellent at protecting soil from rain and are practical erosion-control measures. Use native types of trees and shrubs wherever possible. They are well adapted to our climate, insects, and diseases. Native trees and shrubs also create a landscape that needs minimal maintenance and is more natural.
- **Plant trees and shrubs** to help buffer harsh winter winds and provide shade during hot summer days. Plants also serve as a living "fence" to provide privacy and excellent habitat for birds and other wildlife.
- **Use pesticides and fertilizers carefully.** Use only approved pesticides and follow label directions. See fact sheet #9 for more information.
- **Plan streets and roads.** Roads that follow general contours and moderate slopes offer less obstruction to natural drainage. They are also easier to stabilize and maintain. Plan driveway grades of 10% or less. Where steep slopes cannot be avoided, consider putting in "water bars." These small, raised ridges on the road surface help to route runoff water to road ditches, rather than allowing it to run the entire length of the slope. Properly sized culverts are also important for a well-drained road bed. See fact sheet #8 for more information.

Check these off as you draw them on the plan:

_____ contour elevations of your property (OR note steep slopes and flat areas)

_____ areas where you will be excavating and filling

_____ soil types (e.g., clay, sandy loam)

_____ property boundaries

_____ setback distances between shoreline and structures

_____ elevations of important features such as buildings, drainage outlets, or wetlands

_____ drainage patterns (streams or drainageways)

_____ location of electric, gas, water, or sewer utilities

_____ areas needing protection to prevent erosion such as unstable slopes and steep embankments

_____ vegetation (to be removed, added, or left as is)

_____ ordinary high water level of lake or river

_____ scale (usually number of feet per inch)

_____ north directional arrow

Big, old dead trees, brushpiles, and unmowed grass are "home" for a wide variety of wildlife. Save these whenever possible.

Use vegetation to help direct people away from sensitive areas, such as steep slopes.

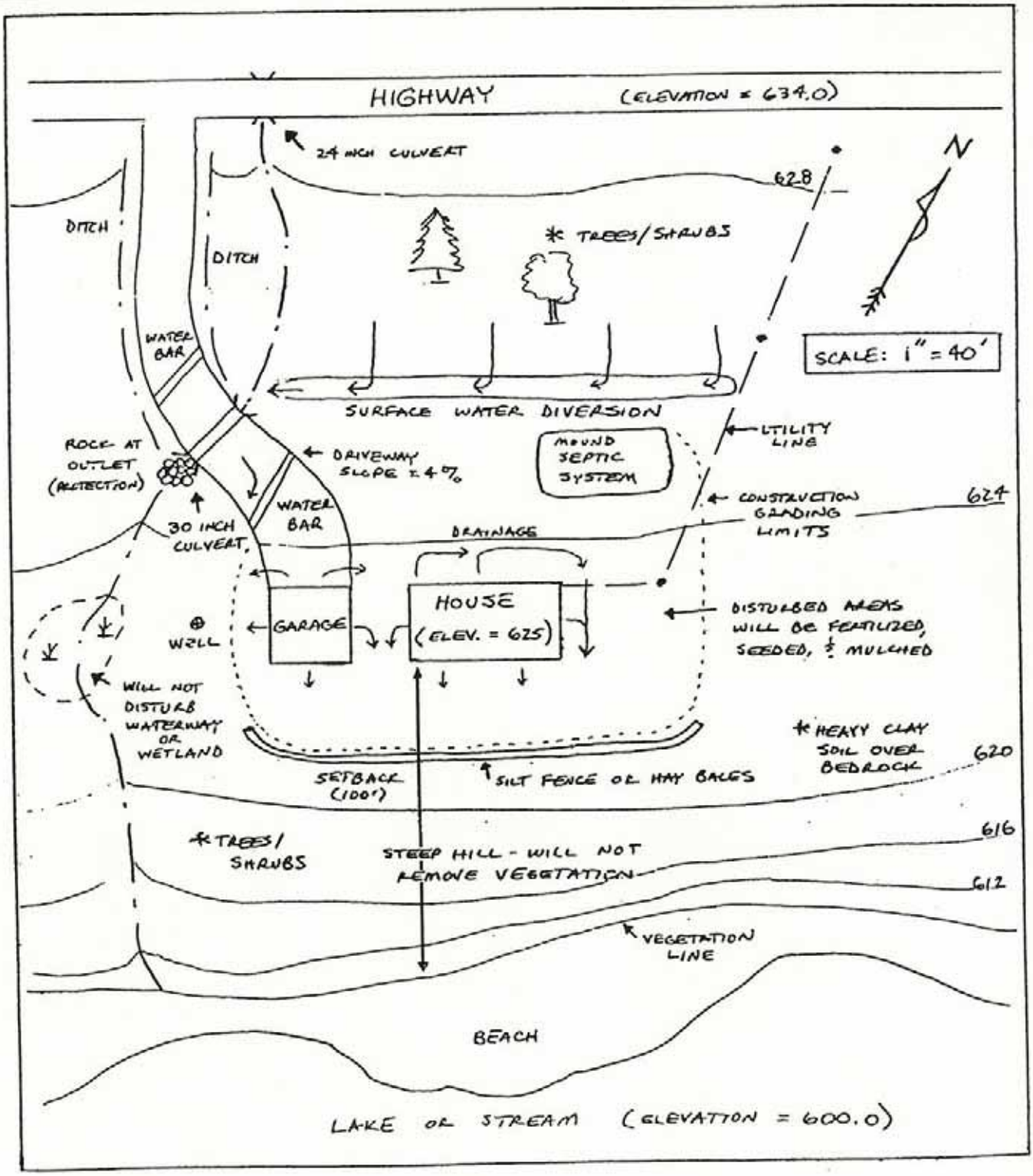

Figure 1: A landscaping plan should include roads, buildings, topography and slope, shoreline, and vegetation.

Remember to maintain an adequate turnaround area near your home for emergency vehicle access.

- **Control runoff.** Rainfall and snow melt runoff should be directed to safe drainageways so that water will not scour and wash away soil. Curbs of dirt, timber, or other materials can be placed at the crests of steep hills or cuts to divert runoff away from unprotected slopes. Diversions can also be constructed to control runoff. They collect runoff and lead it downhill to a safe outlet.

  Don't forget that "hard" surfaces are impermeable to water and increase runoff. These impermeable surfaces include building roofs, roads, driveways, and patios. Minimize the amount of hard surfaces to help control excess runoff.

  To prevent runoff damage by water:

- keep it **spread out,** moving slowly
- **divert** it away from sensitive areas
- direct it to **flow over erosion-resistant materials** such as dense sod, rocks, plastic sheeting, or concrete
- **protect natural drainageways from** filling with sediment

Regulations that Apply

Before beginning any landscaping or construction, check with your local zoning department for information on shoreland requirements including setbacks, permits, and building codes. Most ordinances restrict the total surface area that may be covered with impermeable materials. These include driveways, roofs, and patios.

For More Information...

call

local contractors:

– information on building conditions

county offices:

• University of Minnesota Extension Service

– information on native or adapted plant species, soil testing, or landscape planning

• Soil and Water Conservation District (SWCD)

– information on conservation planning, soils, erosion control, wetlands

• Planning and Zoning Department

– information on zoning regulations, wetlands

regional offices of MN State agencies:

• MN Department of Natural Resources (DNR)

– information on wildlife or fish habitat, shoreline erosion, permits

PART OF A SERIES...

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Minnesota Department of Health
Minnesota Department of Natural Resources, Division of Fish and Wildlife, Division of Waters, Division of Forestry
Minnesota Pollution Control Agency
Minnesota Sea Grant Extension Program
Mississippi Headwaters Board
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Soil and Water Conservation Districts of the Arrowhead counties
Natural Resources Conservation Service
Environmental Protection Agency
Western Lake Superior Sanitary District

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UNIVERSITY OF MINNESOTA
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PROTECTING our waters

Stabilizing Your Shoreline to Prevent Erosion

SHORELAND BEST MANAGEMENT PRACTICES

NUMBER 7 IN THE SERIES

What Are Shoreland BMPs?

Best Management Practices (BMPs) are actions you can take to reduce your impact on the environment. BMPs have been described for agriculture, forest management, and construction. This fact sheet describes BMPs you can adopt on your shoreland property to help protect and preserve water quality. In many cases, the best management for shorelands may be retaining the natural characteristics of your property.

Recognizing Erosion Problems

With more shoreline than California, Florida, and Hawaii combined, Minnesota is bound to have areas where shoreland erosion is a problem. It is obvious that wave-pounded properties lose soil and ultimately their value. What is not as obvious is that this erosion process can be accelerated or slowed by the practices you adopt, and that sediment going into the lake or river is a pollutant.

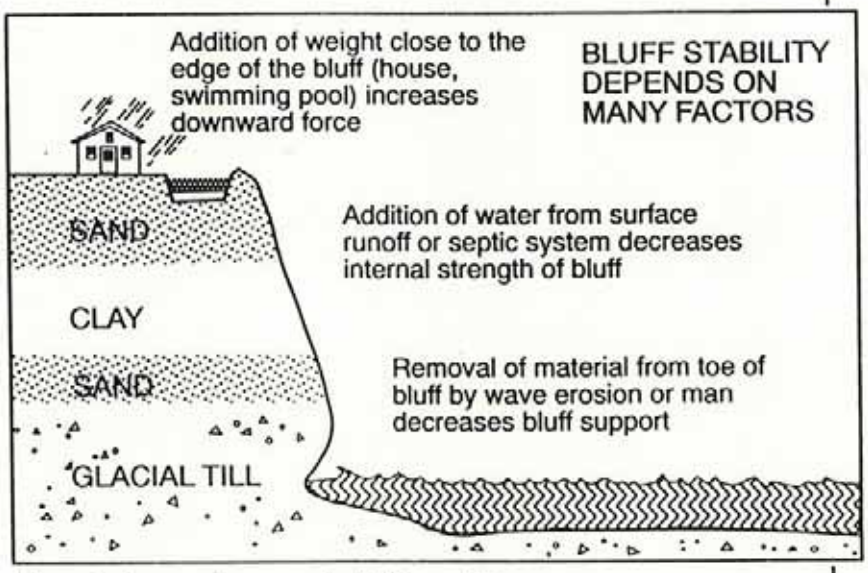

Figure 1: Factors that can make bluffs unstable.

Erosion is a natural process and, therefore, some sediment does end up in surface water. Clearing shoreland vegetation and beach rocks, and increasing runoff to the shore will accelerate shoreland erosion.

Bluff Stabilization

Increased runoff is especially detrimental to high bluffs (Figure 1). Slumping of waterfront bluffs results from unstable soil, usually because surface or ground water is reaching the bluff. On lakes, waves can erode supporting soil at the bottom of the bluff and cause slumping. Along river bluffs, river currents may erode the supporting soil.

Erosion of higher shoreline bluff areas can be prevented by:

- retaining moisture-absorbing vegetation on the bluff
- outletting rain gutters and diverting surface runoff away from the bluff
- reducing runoff rate toward the bluff
- minimizing paved areas that increase runoff
- limiting ground water flow toward the bluff
- installing septic systems and drainfields away from the bluff
- avoiding additional weight on the bluff edge, such as pools, buildings, or storage sheds

Produced by the Arrowhead Water Quality Team, a cooperative effort of Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis counties and state and federal agencies. All publicly funded agencies involved are committed to equal opportunity education, service, and employment.

On property with steep slopes or bluffs, reducing the amount of water reaching the bluff will help with stabilization. If diverting water away from the bluff is impractical, it should be routed through a nonperforated plastic drain pipe that outlets at the very bottom of the bluff. Rock should be placed around the outlet to prevent erosion at the bottom of the drain.

Surface water and some ground water can be intercepted before it reaches the bluff by installing a "French drain" (Figure 2).

A French drain is a narrow trench set back from, but parallel to, the top of the bluff and filled with free-draining sand or gravel. A perforated, corrugated plastic pipe at the bottom collects water and should drain away from the bluff. The entire perforated length of pipe must be wrapped with fabric or a filter sock. Installing deeper drains will intercept more ground water and provide better protection for the bluff.

No additional weight such as a building, garage slab, or vehicle should be placed near the top of the bluff. Septic systems and swimming pools are especially inappropriate near the top of a bluff because they add weight and water.

For most property that slopes toward water, leaving the natural shoreland undisturbed is often the best and least expensive protection

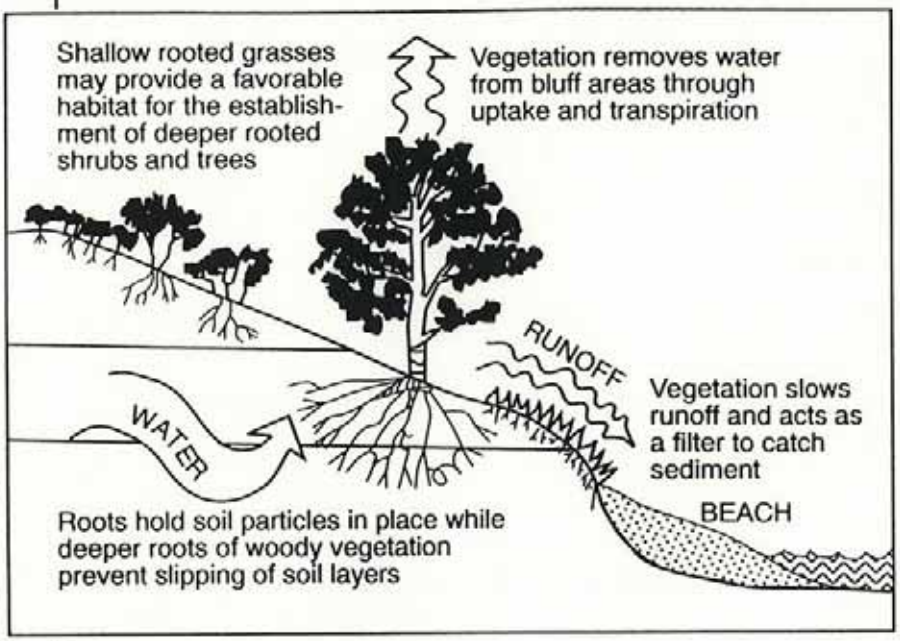

Figure 3: Well-established vegetation on the shore stabilizes the soil and helps remove water.

against erosion. A filter strip of thriving vegetation on and near the shore binds the soil and minimizes soil loss from surface runoff and waves, and from use by people (Figure 3). Existing vegetation can be enhanced by planting woody or aquatic plants.

Natural shoreline features provide natural protection. While swimmers may not enjoy walking on cobblestones, and an ice-pushed ridge may block some of the view from your lawn chair, these features help "nourish" your beach by reducing erosion and trapping sand. Even driftwood absorbs a certain amount of wave energy that otherwise erodes soil.

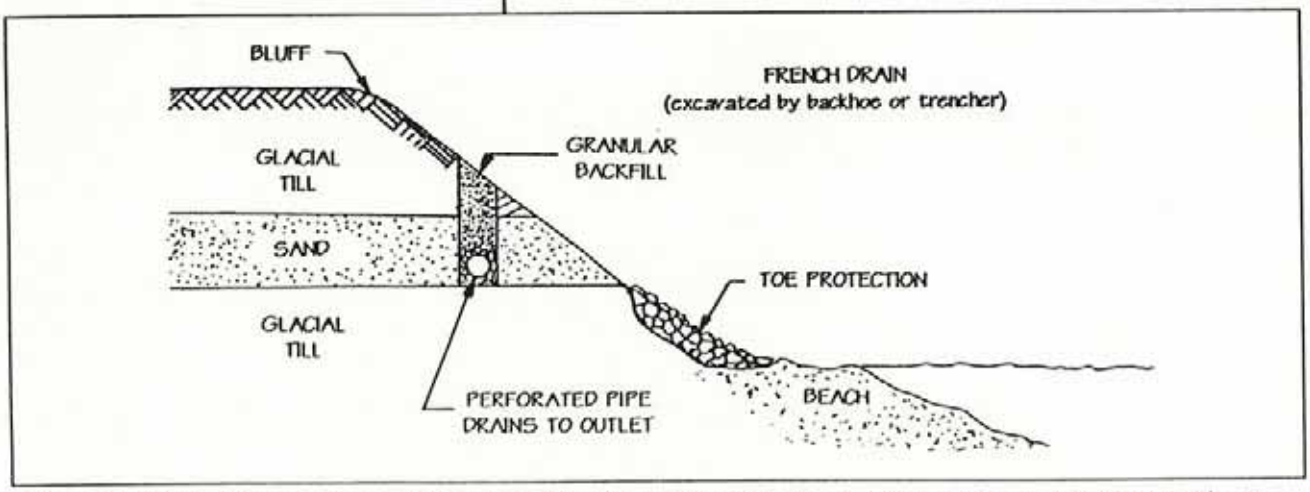

Figure 2: French drains intercept surface water and increase soil stability. Deeper drains will intercept more ground water, but shallower drains are effective also and may cause less disturbance on the bluff. The maximum depth for French drains is 15 to 20 feet.

Shore Protection

Regardless of the natural protection on your shore, the right combination of conditions (such as high lake level and wind direction) can result in a severe wave pounding, and shoreland soil may need additional protection.

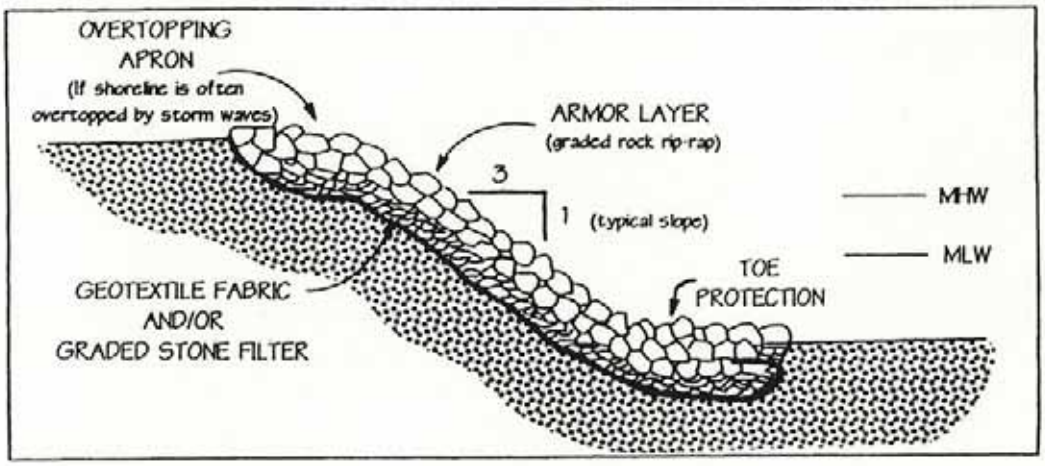

Figure 4: Proper rip-rap placement (MHW = mean high water, MLW = mean low water).

Placement of large rock, usually referred to as rip-rap, is the preferred and most common form of shore protection (see Figure 4). Technical methods are available to determine rock size, placement geometry, and elevations to ensure the best protection. Your county Soil and Water Conservation District (SWCD), the MN Board of Water and Soil Resources (BWSR), and the federal Natural Resources Conservation Service (NRCS) can provide technical assistance.

The above agencies will also have information on other types or remedies that may be appropriate for your particular situation. Potential shore protection alternatives include:

- bulkheads (retaining walls)
- gabions (rock-filled wire baskets)
- articulating blocks (cable-connected concrete blocks)
- Geoweb matrix (thick, open-cell plastic grid)

A few of the alternatives can be placed by hand. Some other alternatives, such as railroad ties, are often tried but rarely work. If you have your own idea for a solution, you should seek technical advice first.

If rip-rap is used, crushed or blasted rock locks together better than rounded boulders, but can be very expensive unless it is readily available.

Geotextile fabric is usually placed beneath the rock rip-rap to prevent soil loss through the rip-rap openings. It is easy to place and provides an excellent filter barrier (Figure 4). In order to prevent punctures, plenty of slack should be provided over protruding objects that cannot be removed. A layer of sand or fine gravel can be placed on the fabric for extra protection against puncture. Enough fabric should be laid out so that the rip-rap periphery can be "wrapped" by bringing the fabric up and back down into the rip-rap. This will help hold the rip-rap together as one structural unit. Keep in mind that sunlight will degrade exposed fabric. As an alternative to the fabric, a graded filter layer can be used beneath rip-rap to prevent soil loss through the rip-rap openings.

Sufficient rock must be placed at the base of the rip-rap for toe protection. Excavated toe material must be removed from the lakebed and placed in a non-wetland area.

Costs

The price of rip-rap placement depends on local contractors, distance to the nearest rock source, and access to the project site. It also depends on how much other work, such as clearing or earthwork, is required.

If you are planning to start a project in the mid- to late-1990s, you should expect to pay $40-75 per shoreline foot for inland lake shorelines and $100-175, or more, per foot for Lake Superior shoreline protection. Inquire at the county SWCD office about cost-share assistance.

A project cost can also be estimated by calling earthwork contractors in your area. A big savings can be realized if you can install these items yourself.

If you want to stabilize a slumping bluff, find out about soil types and ground water level. The record from when your well was drilled may be a good information source and can be obtained from the state or county health department or from your well driller. Contact your county SWCD for information on soils.

Effective bluff stabilization will require technical assistance. Request an engineer from the BWSR, SWCD, or NRCS to inspect your site, or consider hiring a geotechnical engineering firm to take soil borings, analyze soil properties, and recommend a remedy. Most private consulting firms can drill 100 feet a day and charge $1,000 a day. For a small site, drilling, analysis, and a recommendation will cost about $2,000 (1996).

Regulations that Apply

All erosion protection projects that alter the lake- or riverbed require a protected waters permit from the Department of Natural Resources (DNR). Contact the DNR Area Hydrologist for permit guidelines, which other agencies might require a permit, and for assistance in planning your erosion prevention project. Some rip-rap projects may not need a permit. For those projects requiring a permit, the fee is $75 (1996). Permit fees for projects other than rip-rap are a minimum of $75 (1996).

For More Information...

call

county offices:

- University of Minnesota Extension Service
- Soil and Water Conservation District (SWCD)
- Planning and Zoning Department

regional offices of MN State agencies:

- MN Board of Water and Soil Resources (BWSR)
- MN Department of Natural Resources (DNR) (Area Hydrologist)

federal agencies:

- Natural Resources Conservation Service (NRCS)
- U.S. Army Corps of Engineers (USACoE)

read

Streambank Erosion...Gaining a Greater Understanding. Available from DNR.

Rip-Rap Shore and Streambank Erosion Brochure. Available from DNR.

Low Cost Shore Protection...a Property Owner's Guide. U.S. Army Corps of Engineers.

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UNIVERSITY OF MINNESOTA
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PROTECTING our waters

Minimizing Runoff from Shoreland Property

SHORELAND BEST MANAGEMENT PRACTICES

NUMBER 8 IN THE SERIES

What Are Shoreland BMPs?

Best Management Practices (BMPs) are actions you can take to reduce your impact on the environment. BMPs have been described for agriculture, forest management, and construction. This fact sheet describes BMPs you can adopt on your shoreland property to help protect and preserve water quality. In many cases, the best management for shorelands may be retaining the natural characteristics of your property.

Why Is Runoff a Problem?

When an area is developed or altered, the way water flows is also changed. As land surfaces are covered with roads, driveways, or impervious surfaces (rooftops, decks, sidewalks, and parking lots), less water can seep into the soil, so runoff increases. This increased runoff is usually channeled into ditches, drainageways, storm sewers, or road gutters and often ends up in nearby lakes and streams.

High flows of water can cause flooding or erosion, as well as increasing sediment in streams and lakes. Fine sediment can also transport nutrients such as nitrate or phosphorus, and pollutants such as sands or salts from icy roads. All of these processes have an adverse effect on water quality.

Preventing Runoff

Planning ahead is the first and most important step in preventing or minimizing erosion due to runoff. An easy way to do this is to pretend that you are a raindrop. In looking at the landscape or any impervious surfaces, which route would you travel? Obviously, you would want to take the easiest path downhill. Keeping that in mind, note any areas that runoff would choose to travel.

Evaluate your property before you begin your landscape design. Consider slope, soil type, and existing vegetation as you plan your development. Fact sheet #6 offers additional tips for landscape planning.

Identifying Problems Caused by Runoff

PROBLEM	POSSIBLE CAUSE
• Is the water near shore cloudy?	• excess sediment reaching the water
• Is there an oily rainbow film on the water?	• possible petroleum contamination
• Are there algal blooms, green scum, or abundant plant growth in the water?	• excess nutrients such as nitrate or phosphorus reaching the water
• Are washouts, trenches, small piles of sediment, leaves, or debris found at the bottom of slopes?	• excessive runoff across the property

Produced by the Arrowhead Water Quality Team, a cooperative effort of Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis counties and state and federal agencies. All publicly funded agencies involved are committed to equal opportunity education, service, and employment.

Long-term BMPs

Follow these long-term BMPs to minimize runoff and prevent erosion:

- Limit paved and covered areas that prevent water from seeping into the ground.
- Invest in permanent stabilization practices for long-term protection of your shoreland property by planting new vegetation, installing erosion control structures, and diverting drainage.
- Retain trees and shrubs; trees provide a natural umbrella by shedding water and can reduce runoff by as much as 50%; fact sheets #6, 9, and 11 offer landscaping tips.
- Plan and complete an annual maintenance schedule to make sure that your runoff and erosion control plan is working to protect your property.
- Limit clearing and grading on slopes and minimize cutting and filling for roads, sidewalks, and footpaths to reduce erosion and still provide access.
- Avoid damaging adjacent property with temporary erosion control methods, because water does not stop flowing at your property line.

Drainageways

- Use existing natural drainage systems such as valleys or low areas instead of digging new ditches.
- Design culverts and drainage structures to handle excessive amounts of runoff; assistance is available from your county Soil and Water Conservation District (SWCD) or the Natural Resources Conservation Service (NRCS).
- Protect storm sewers from sedimentation so they are able to carry storm water as intended.

Roads, Driveways, and Sidewalks

- Minimize pavements and impervious surfaces.
- Use gravel driveways instead of pavement.
- Where paved areas are necessary, locate them as close to the main road as possible to minimize the length of paved driveway.
- Do not pave wasted space such as corners near buildings that are not large enough for parking or driving.
- Locate driveways, sidewalks, stairways, and footpaths away from slopes because steeper slopes have greater erosion potential; if you must cross a hillside, follow the contour of the slope.
- Use steps when a walkway must go directly up and down a slope, particularly near the waterfront.
- Minimize road crossings over waterways and cross at a right angle to the stream if possible.
- Sweep driveways or sidewalks instead of washing them down with a hose, to prevent sediment, salt, and petroleum products from washing into storm sewers; cover stockpiles of salt and sand with a tarp or store them in a building.
- Use shallow grassed areas by roadsides instead of curb and gutter runoff and storage for snow.
- Install water bars on sloping roadways to slow and divert runoff.
- Use paving stones instead of solid concrete for walkways; this allows water to seep around the stones instead of running off.
- Avoid shortcutting down slopes because shortcutting causes erosion; compacted soil on footpaths also promotes excessive runoff.

Landscaping and Construction

- When landscaping, stage construction so one area is stabilized before another area is disturbed.
- Avoid construction in areas with:
  - little vegetative cover; preserve existing cover
  - erodable soils (sands, or soils that appear fluffy when dry)
  - mainly bedrock with a thin covering of soil
  - steep slopes of greater than 10%; to picture a 10% slope, imagine putting the bottom end of a board 10 feet out from the wall and the top end at 1 foot up the wall; this is a 10% slope (see Figure 1)

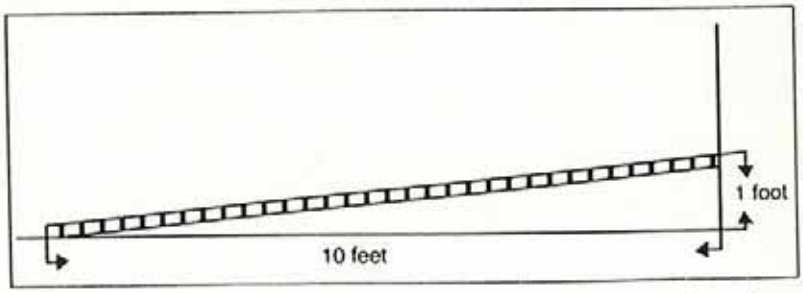

Figure 1: A 10% slope is represented by leaning a board against the wall with the top at 1 foot and the base set 10 feet away from the wall.

- Control erosion during construction by using temporary methods such as **diversions** to carry water away from the construction site to where it can be safely dispersed or **silt fences** or **hay bales** to trap sediments before they enter the water; a combination of methods may be the best solution (see Figures 2 and 3).

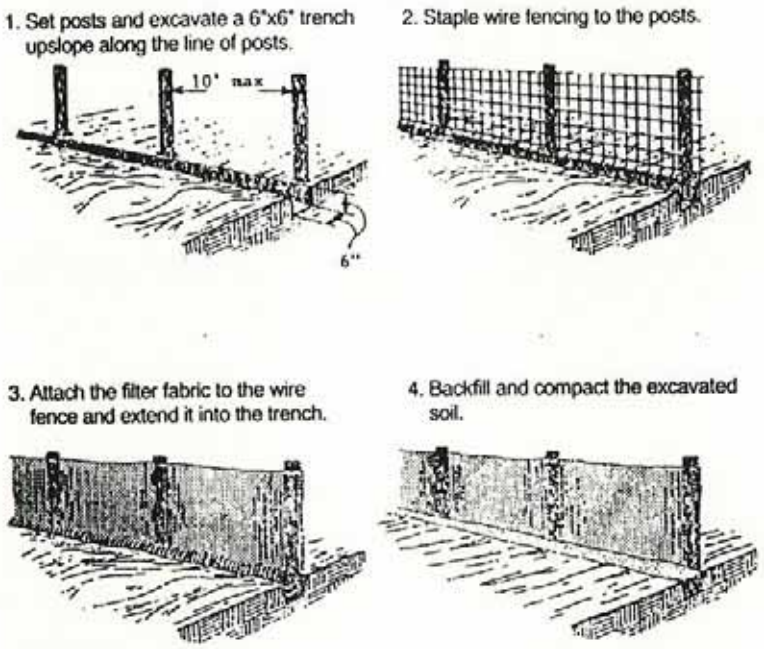

Figure 2: Constructing a silt fence to slow runoff and prevent erosion.

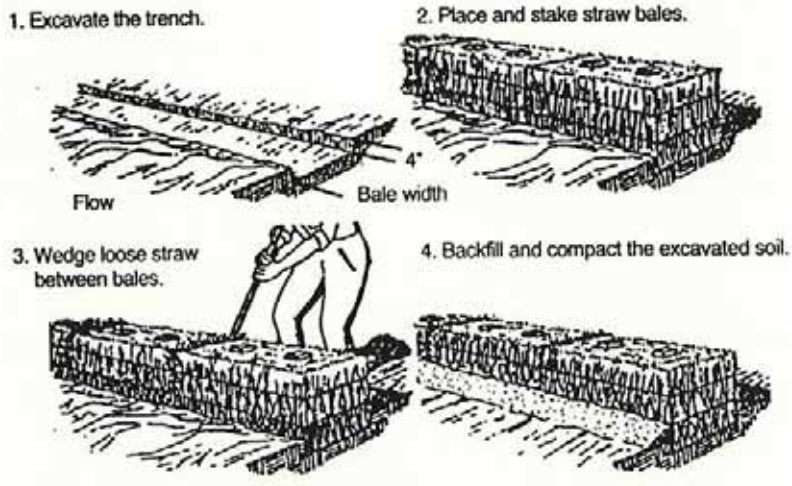

Figure 3: Constructing a straw bale barrier to slow runoff and prevent erosion.

- Use only clean fill (free from debris and dirt) such as rock, sand, or gravel near lakes and streams.
- Use only solid concrete forms such as interlocking blocks or slabs; do not use liquid concrete and avoid treated timbers or railroad ties.
- Make sure utility trenches are drained of water, backfilled, seeded, and mulched.
- Inspect construction projects immediately after initial installation of erosion control measures, during construction, following any severe rainstorm, before reseeding, and when nearing the completion of construction work; temporary erosion controls should be removed; ensure that stabilization is complete and drainageways are in proper working order.

As a general rule, the erosion hazard will become critical if slope lengths exceed these values:

0-6%	*200 feet*
6-12%	*100 feet*
13% and over	*50 feet*

Buildings and Runoff

- Install rain gutters along the edge of rooftops to help carry water off of the roof and away from the building to areas where soil won't be eroded; make sure there is erosion protection where the gutters outlet onto soil.
- Keep gutters free from debris and draining properly.
- Keep rooftops free of snow and ice buildup to help control the magnitude of runoff in the spring and protect your roof from damage.
- Pave patios with flagstones or decay-resistant wood blocks instead of solid material to permit some water to seep around the stones or blocks.

- Position rooftops so they are perpendicular to the slope, instead of parallel, to slow down runoff (Figure 4).

roofline perpendicular to slope slows down runoff

roofline parallel to slope increases potential for runoff damage

Figure 4: Build rooflines perpendicular to slopes

Regulations that Apply

Most zoning ordinances restrict the amount of impermeable surface allowed in the shoreland area; check with your local zoning officials for more information. Alteration or filling of wetlands is strictly regulated; check with your county Soil and Water Conservation District before beginning any projects that impact wetlands. For any development along waterways or lakeshores, contact the Department of Natural Resources, Division of Waters for any necessary permits.

Remember

It is a Minnesota law that you must "call before you dig." Contact Gopher State One Call 1-800-252-1166.

For More Information...

call

county offices:

- Soil and Water Conservation District (SWCD)
- University of Minnesota Extension Service
- Planning and Zoning Department

federal agencies:

- Natural Resources Conservation Service (NRCS)

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You may add information about contact persons or regulations specific to your county, region, or lake association.

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University of Minnesota
Extension Service

PROTECTING our waters

Caring for Shoreland Lawns and Gardens

SHORELAND BEST MANAGEMENT PRACTICES

NUMBER 9 IN THE SERIES

What Are Shoreland BMPs?

Best Management Practices (BMPs) are actions you can take to reduce your impact on the environment. BMPs have been described for agriculture, forest management, and construction. This fact sheet describes BMPs you can adopt on your shoreland property to help protect and preserve water quality. In many cases, the best management for shorelands may be retaining the natural characteristics of your property.

Why Are Lawns and Gardens a Potential Problem?

Lawns and gardens near shorelands must be carefully planned and maintained to prevent possible contamination of surface waters. Native vegetation should be considered as a quality alternative to cultured lawns and landscapes. Landscapes will revert to a native state if no maintenance is performed; planting native vegetation will hasten the process.

Establishment of new lawns must conform to Shoreland Management Regulations, which prohibit excessive removal of vegetation near the shore and on slopes and bluffs. Check with your local zoning authority for specific regulations governing the body of water in question.

Existing lawns and gardens must be maintained in a manner that prevents the possible contamination of ground and surface waters.

Before beginning any practice, stop and think about potential risks to water quality. Shoreland owners must be aware of potential problems caused by soil erosion, as well as pollution due to chemical amendments and organic yard waste.

Special attention should be paid if the following conditions exist:

- There are areas of exposed soil—flower beds, vegetable gardens, or poorly established vegetation.
- Soils have a coarse texture, such as sands or sandy loams.
- The property slopes toward surface water.
- There are impervious surfaces, such as sidewalks and driveways.
- Lawn or landscape maintenance is being done close to the surface water.
- Fertilizers, pesticides, or soil amendments are being applied.

Avoid or minimize the use of chemical fertilizers and pesticides.

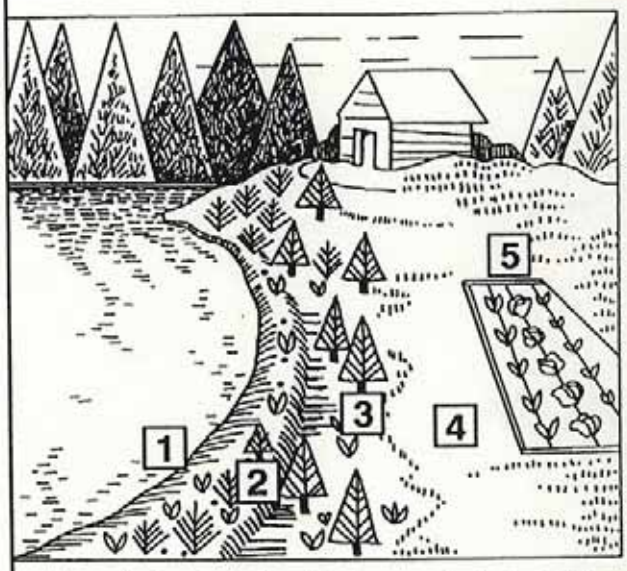

Figure 1: A well-designed landscape plan includes ① natural vegetation along the water's edge; ② an intact ice ridge or added berm; ③ a natural vegetation filter strip; ④ well-established grass or ground cover; and ⑤ a level garden set back from the waterfront.

Preventing Soil Erosion

Surface waters can be contaminated by soil particles that are washed or blown into the water. In addition to the problem of sediment, soil particles can carry phosphorus, which is a potential pollutant, into the water.

Produced by the Arrowhead Water Quality Team, a cooperative effort of Carlton, Cook, Itasca, Koochiching, Lake, and St. Louis counties and state and federal agencies. All publicly funded agencies involved are committed to equal opportunity education, service, and employment.

To avoid this problem:

- maintain a vigorously growing filter zone of grass, trees, and shrubs next to surface waters
- minimize areas of exposed soil by maintaining native vegetation or dense turf
- preserve ice ridges or construct an earth berm near the shore to minimize the possibility of runoff; the berm, which is a small mound of earth, should run parallel to the shore to prevent runoff into surface water

Preventing Potential Problems from Fertilizers

If possible avoid the use of chemical fertilizers. Native vegetation does not require the application of additional fertilizer. Use caution if applying fertilizers to lawns and adhere to the following guidelines:

- **Have your soil tested to determine how much fertilizer is needed and minimize the use of chemical fertilizers; soil test sample bags are available through the county offices of the University of Minnesota Extension Service.**
- Use compost or manure; this is preferable to chemical fertilizer. However, these also have the potential to damage water quality if used in excessive amounts.
- If chemical fertilizers are used, select slow-release (water insoluble) forms; see recommendations for fertilizing on next page.
- Water your lawn after fertilizing, but do not allow excess water to run off into surface waters.
- Sweep up any fertilizer spilled on hard surfaces such as walks and driveways, instead of washing it off.
- Use extra caution when applying fertilizer near surface waters; do not spread fertilizer within 75 feet of surface waters or wetlands; use a "drop" spreader and not a "cyclone" spreader to minimize the possibility of getting fertilizer directly into the water.
- Never apply fertilizers to frozen ground.
- Leave a natural vegetation filter strip of grass, trees, and/or shrubs next to the shoreline; another option would be to construct a berm along the shore.

Preventing Potential Problems from Pesticides

If possible avoid the use of chemical pesticides. Consult a professional from the University of Minnesota Extension Service or Soil and Water Conservation District to determine if the use of a pesticide is justified. The following practices will minimize the potential of contamination from pesticides:

- Properly identify whether the pest is an insect, disease, or other problem.
- Determine if there is an economic or aesthetic justification for initiating control of the pest.
- Consider control options other than the use of a chemical pesticide; **biological controls and pest-resistant plant varieties are becoming more available.**
- Use the least toxic and most readily degradable pesticide that will be effective.
- **Read the pesticide label carefully and pay special attention to safety precautions and warnings about use near water.**
- Do not apply pesticides when it is windy to avoid the possibility of drift.
- When purchasing pesticides, buy only what is needed to control the problem during the current season.
- Waste pesticides should be disposed of properly. Never pour excess pesticides on the ground, into surface waters, or into sanitary treatment systems; consult with your county solid waste office, the Minnesota Pollution Control Agency, or your sanitary district for proper methods of collection and disposal.

Best Management Practices for Lawns

The establishment of new lawns must conform to Shoreland Management Regulations. Natural vegetation cannot be excessively removed from the "Shore Impact Zone," generally a distance of 50 to 100 feet from the surface water, depending upon the county, and lake or river classification. Removal of vegetation from slopes and bluffs is also regulated. **Check with your local zoning authority for specific regulations.**

ESTABLISHING NEW TURF

- If permitted by regulation, a grass lawn can be established with either sod or seed.
- **Sod should always be used if there is a slope and the danger of soil erosion exists.**
- Seeding is effective if runoff is not a problem and if the seedbed can be kept moist. Bluegrass seed requires three weeks to establish, and if the seed bed dries out during this time, the seedlings may die.
- When seeding, preparation of a good seedbed is necessary for success. Seed-soil contact is essential. Select seed varieties that are suitable for full sun or partial shade. For specific recommendations consult *The Home Lawn,* University of Minnesota Extension Service Bulletin MI-0488.

MAINTAINING ESTABLISHED TURF

Fertilizing

For dense growth, grass requires the addition of some form of nitrogen fertilizer. **Nitrogen is a very mobile nutrient and attention must be paid to application rates and timing to eliminate the possibility of water contamination.**

- Do not apply more than 1 lb. of actual nitrogen per 1,000 square feet of lawn per year. If soils are sandy or grass is sparse, 1/2 lb. of nitrogen per 1,000 square feet per application is appropriate. (The analysis of fertilizers is a percentage by weight. For example, a 34-0-0 fertilizer is 34% nitrogen by weight; 3 lb. of fertilizer contains 1 lb. of actual nitrogen.)
- Low-maintenance lawns will grow well with one application of fertilizer per year (1 lb. of actual nitrogen per 1,000 square feet). The best time of year to apply this fertilizer is in the early fall, during the month of September.
- The use of slow-release nitrogen is desirable. This may be some form of organic fertilizer or "synthetic" slow-release form.
- Never apply fertilizer to frozen ground or on snow.
- Use extreme caution when applying fertilizers near water. Never allow any fertilizer to enter surface water or wetlands.
- Always sweep up any fertilizer that is on hard surfaces and reapply to the grass. Never wash it off.
- Apply commercial fertilizers just before moderate rain or irrigate immediately after application.

Watering

- Bluegrass lawns generally do not require watering. They will become dormant during the dry part of the summer, but will revive when it rains.
- If quality growth is desired throughout the season, bluegrass lawns will require additional water during dry summer months.
- Water deeply, but infrequently. Sandy soils require 1 or 2 inches of water per week. Clay soils require 1 inch of water per week.
- Water in the early morning to prevent water loss due to evaporation and to minimize the potential for disease.

Mowing

- Mow regularly and leave the clippings on the grass. By leaving the clippings on the lawn, nutrients are naturally recycled to the grass plants.
- Never allow grass clippings to enter the water. Clippings and other organic material contain nutrients that may contaminate the water.

With proper management, dense turf provides a good ground cover to prevent soil erosion.

BMPs for Gardens

Flower and vegetable gardens can add to the quality of life for shoreland owners. Certain precautions must be taken to prevent the possibility of surface water contamination.

LOCATION

- Gardens should **not** be located on slopes because they can promote accelerated soil erosion and runoff. An alternative on slopes is to install a terraced garden. Dense turf or other vegetation should be established on slopes.
- Gardens should **not** be located on septic system drainfields or mounds. Exposed soil increases the possibility of septic systems freezing. Drainfields and mounds should be covered with dense turf.
- To minimize the area of exposed soil, use intensive growing techniques such as intercropping, succession planting, and raised beds.

SOIL FERTILITY MANAGEMENT

Excessive application of fertilizers has the potential for ground and surface water contamination. This can be avoided by the following practices:

- Test the soil to determine nutrient needs; apply only the recommended amounts of nutrient; soil test bags and forms are available at the county offices of the University of Minnesota Extension Service.
- Make split applications of the total amount of nutrient required; this would include "side-dressing" nitrogen-loving crops, such as sweet corn, vine crops, and the cabbage family.
- Use organic fertilizers if available and practical; these include well-rotted manures and compost.

PEST MANAGEMENT

- Use pesticides only if necessary and if there are no other options for pest control. See section on "Preventing Potential Problems from Pesticides," p. 2. **Always read the pesticide label and pay careful attention to warnings on the potential for surface water contamination.**

VEGETABLE WASTES

- Vegetable wastes, such as corn husks, pea pods, or other plant material, should never be deposited in the water. Compost these materials instead and apply to garden soil.

Yard Waste Disposal

Yard waste, including leaves, grass clippings, fruit and vegetable wastes, and woody materials, should never be allowed to enter the water. These materials contain phosphorus and may contribute to degradation of surface water quality.

Collect and compost yard waste. Compost provides an excellent material for amending flower and vegetable gardens. Information on composting is available from your county office of the University of Minnesota Extension Service or the County Solid Waste office.

For More Information...

call

county offices:

- University of Minnesota Extension Service
- Soil and Water Conservation District (SWCD)
- Planning and Zoning Department

regional offices of MN State agencies:

- MN Department of Natural Resources (DNR)
- MN Pollution Control Agency (PCA)
- Western Lake Superior Sanitary District

read

Backyard Composting. FS-3899, University of Minnesota Extension Service

Composting and Mulching: A Guide to Managing Organic Yard Wastes. FO-3296, University of Minnesota Extension Service

The Home Lawn. MI-0488, University of Minnesota Extension Service

Lawn Care Practices to Reduce the Need for Fertilizers. FO-5890, University of Minnesota Extension Service

Soil Sample Bags and Information Sheets. University of Minnesota Extension Service, County Offices

Turfgrass Management for Protecting Surface Water Quality. BU-5726, University of Minnesota Extension Service

PART OF A SERIES...

This fact sheet is one of a series designed to assist shoreland property owners in protecting and preserving water quality. The series includes:

1 Understanding Shoreland BMPs
2 Maintaining Your Shoreland Septic System
3 Installing a Shoreland Septic System
4 Ensuring a Safe Water Supply
5 Limiting Impact of Recreation on Water Quality
6 Developing Shoreland Landscapes and Construction Activities
7 Stabilizing Your Shoreline to Prevent Erosion
8 Minimizing Runoff from Shoreland Property
9 Caring for Shoreland Lawns and Gardens
10 Managing Your Shoreland Woodlot
11 Valuing Your Shoreland Trees
12 Preserving Wetlands
13 Managing Crops and Animals Near Shorelands
14 Reducing the Use of Hazardous Household Products
15 Preventing the Introduction of Exotic Species
16 Accessing Information to Protect Water Quality
17 Shoreland Stewardship Scorecard
18 Conserving Water

This series of fact sheets is a cooperative effort of the following agencies:

University of Minnesota Extension Service of the Arrowhead counties
College of Natural Resources, University of Minnesota
Water Plan Coordinators of the Arrowhead counties
Minnesota Board of Water and Soil Resources
Minnesota Department of Health
Minnesota Department of Natural Resources, Division of Fish and Wildlife, Division of Waters, Division of Forestry
Minnesota Pollution Control Agency
Minnesota Sea Grant Extension Program
Mississippi Headwaters Board
St. Louis County Health Department, Environmental Services Division
Soil and Water Conservation Districts of the Arrowhead counties
Natural Resources Conservation Service
Environmental Protection Agency
Western Lake Superior Sanitary District

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