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# Appendices

## A1. Minnesota Land Cover Classification System (MLCCS) Inventory

**The MLCCS and Legend Definitions.** The Minnesota Land Cover Classification System is a comprehensive system for classification of land cover and is composed of hundreds of distinct land cover types. The Mississippi River Bluff project area has eleven MLCCS land cover types. General descriptions of these eleven cover types are provided below. *Four of these eleven cover types are considered natural communities based on the Minnesota Natural Heritage's publication "Minnesota's Native Vegetation: A Key to the Natural Communities, Version 1.5", and are indicated with an \* in the following text.* Natural communities, semi-natural communities, and "cultural" land cover types (such as paved surfaces) are shown on **Figure 2**.

**\*Cottonwood Floodplain Forest:** Vegetation with greater than 30% tree cover that is subject to occasional floodplain inundation and is dominated by Cottonwoods in the canopy. Additional canopy species such as American elm, box elder, black willow, silver maple, green ash and hackberry are also found in this classification. The subcanopy and shrub layer is sparse with dominant species being saplings and seedlings of the canopy species and exotic species such as buckthorn. Herbaceous species such as wood nettle, clearweed and exotic species (e.g., garlic mustard) dominate the ground layer. Woody and herbaceous climbers are common, especially wild grape, wild cucumber and Virginia creeper.

**\*Silver Maple Floodplain Forest:** Vegetation with greater than 30% tree cover that is subject to occasional floodplain inundation and is dominated by silver maples in the canopy. Additional canopy species such as American elm, box elder, black willow, cottonwood, green ash and hackberry are also found in this classification. The subcanopy and shrub layer is sparse with dominant species saplings and seedlings of the canopy species and invasive species such as buckthorn. Herbaceous species such as wood nettle and clearweed dominate the ground layer. Woody and herbaceous climbers are also common, especially wild grape, wild cucumber, bur-cucumber, groundnut and hog-peanut.

**\*Maple-Basswood Forest:** An upland deciduous forest where sugar maple, basswood, and (formerly) American elm dominate the canopy or where they dominate along with oaks. Additional canopy species include northern red oak, bur oak, and green ash. The canopy is very dense, with tall, straight, relatively narrow-crowned trees. The understory is multi-layered and patchy. It is composed of saplings and seedlings of the canopy species (especially sugar maples), along with ironwood, bitternut hickory, pagoda dog-

wood, and leatherwood. Exotic species, such as common buckthorn, are also commonly found in the understory and shrub layer. The ground layer is comprised of many spring ephemerals including Dutchman's breeches, spring beauty, trout-lily, hepatica, wild geranium, etc. Sedge and grass species are also present in the ground layer.

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

**Disturbed Upland Deciduous Forest:** Box elder, green ash and cottonwood are typical canopy dominants, sometimes together and sometimes singly. Hackberry, oak, and basswood may also be present. Both the sub-canopy and shrub layer can often be dominated by the exotic species (such as common buckthorn and Tartarian honeysuckle). Gooseberry and elderberry can also be common. The ground layer is also dominated by species tolerant of disturbances, including white snakeroot, motherwort, and garlic mustard.

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

**Urban Park with Trees:** Mowed turf with scattered deciduous trees located in the floodplain.

**Pavement and Deciduous Trees:** Areas where the sum of pavement and other impermeable surfaces averages 4-75% of the total cover with vegetation cover dominated by deciduous trees.

**Pavement and Grass with Sparse Trees:** Areas where the sum of pavement and other impermeable surfaces averages 4-75% of the total cover with vegetation cover dominated by grasses with sparse trees.

**Pavement and Grass:** Areas where the pavement and other impermeable surfaces average 4-75% of the total cover with vegetation cover dominated by grasses.

**Pavement:** Areas where the pavement and other impermeable surfaces average over 75% of the total cover.

**TOTAL Land Cover Types and Acreage Found in the Project Area:**

**Total Acres:** 297.38

**Total Cultural Land Cover (MLCCS) Acres:** 157.0 (53 % of total)

(Includes Urban Park with Trees, Pavement and Deciduous Trees, Pavement and Grass with Sparse Trees, Pavement and Grass, and Pavement categories from previous page)

**Total Semi-Natural Land Cover (MLCCS) Acres:** 16.0 (5% of total)

(Includes Disturbed Deciduous Woodland and Disturbed Upland Deciduous Forest land cover types from previous page)

**Total Natural Community Remnant Land Cover (MLCCS) Acres:** 124.0 (42% of total)

(Includes all communities identified with an \* on previous pages)

**MLCCS Land Cover Types and Acreage Found in each Priority and Secondary Area:**

**Desnoyer Park Priority Area**

Total Acres: 20.40 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 8.40 (figure 2).

Total Semi-natural Land Cover (MLCCS) Acres: 6.90 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS) Acres: 5.10 (figure 2).

Within this priority area, the MLCCS inventory identified two cultural land cover types (impervious surfaces with sparse trees, and buildings and pavement, 8.4 acres collectively), one semi-natural land cover type (disturbed upland deciduous forest, 6.9 acres) and one natural community remnant (mesic oak forest, (5.1 acres).

**Shadow Falls Priority Area**

Total Acres: 36.14(figure 1)

Total Cultural Land Cover (MLCCS) Acres: 16.84 (figure 2).

Total Semi-natural Land Cover (MLCCS) Acres: 1.80 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS): 17.50 (figure 2).

According to the Minnesota Land Cover Classification, this priority area includes 4 cultural land cover types (11-25% impervious surface with deciduous trees, 4.1acres; 26-50% impervious surface with deciduous trees; 10.8 acres; 51%-75% impervious surface with deciduous trees, 1.5 acres); and deciduous trees on upland soils, 0.4 acres). Cultural and developed land cover types occur entirely on the flat park spaces along the bluff tops and to the east of Mississippi River Boulevard. One semi-natural land cover type (disturbed deciduous woodland, 1.8 acres), and two natural community land cover types (maple basswood forest, 6.2 acres, and mesic oak forest, 11.3 acres) are also found in this area.

**Goodrich to Randolph Priority Area**

Total Acres: 25.30 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 8.80 (figure 2).

Total Semi-natural Land Cover (MLCCS) Acres: 0.0 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS): 16.50 (figure 2).

The MLCCS inventory identified three cultural land cover types within this area: (26-50% impervious surfaces with deciduous trees, 1.1 acres; 51-75% impervious surfaces with deciduous trees, 5.3 acres; and short grasses with mixed trees 26-50% impervious, 2.4 acres), and one relatively large natural community remnant (mesic oak forest, 16.5 acres).

### **Randolph to Ford Parkway Priority and Secondary Area**

Total Acres: 27.60 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 11.30 (figure 2).

Total Semi-Natural Land Cover (MLCCS) Acres: 2.0 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS) Acres: 14.30 (figure 2).

The MLCCS inventory identified six different land cover types within this area: cultural and developed land cover types include short grasses and mixed trees with 26-50% impervious surface, short grasses and mixed trees with 51-75% impervious surface, 91-100% impervious surface, and buildings and pavement, 11.3 acres collectively. Cultural and developed land cover types are restricted to the top of the bluff on the east side of Mississippi River Boulevard, and within the managed park land to the west of the boulevard to the bluff edge. Semi-natural land cover within this area includes an area of box elder/green ash disturbed forest within a pronounced ravine (2.0 acres). Three natural community land cover types were identified in this area, including mesic oak forest (two areas comprising 6.2 acres); maple basswood forest, 4.2 acres; and silver maple floodplain forest, 3.9 acres.

### **Ford Plant Secondary Area**

Total Acres: 79.0 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 40.60 (figure 2).

Total Semi-Natural Land Cover (MLCCS) Acres: 0.0 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS) Acres: 38.40 (figure 2).

Within this secondary area, the MLCCS inventory identified five different land cover types. Three cultural land cover types include 11-25% impervious surfaces with deciduous trees, short grasses and mixed trees with 26-50% impervious surfaces, and hydric soils with planted, maintained or cultivated trees, totaling 40.6 acres in all. Cultural land cover types are located within the boulevard area and park land along the bluffs and adjacent to the Ford Plant building, within the Ford Plant truck parking and dam facilities in the river bottoms, and within the maintained park area of Hidden Falls. Two natural community land cover types were identified in this secondary area, including mesic oak forest (two areas comprising 9.5 acres); and a large floodplain forest remnant, 28.9 acres in size.

### **Hidden Falls North Priority Area**

Total Acres: 48.90 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 38.60 (figure 2).

Total Semi-Natural Land Cover (MLCCS) Acres: 0.0 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS) Acres: 10.30 (figure 2).

Within this priority area, the MLCCS inventory identified eight land cover types. Six cultural land cover types include 11-25% impervious surfaces with deciduous trees, short grasses and mixed trees with 26-50% impervious surfaces, and hydric soils with planted, maintained or cultivated trees, totaling 38.6 acres in all. Cultural land cover types are located within the boulevard area and parkland along the bluffs and within the maintained park area of Hidden Falls. Two natural community land cover types were identified in this area, including mesic oak forest, 4.7 acres; and the southern end of the floodplain forest remnant which extends into the Ford Plant Secondary Area, 5.6 acres in size.

### **Hidden Falls South Secondary Area**

Total Acres: 60.0 (figure 1)

Total Cultural Land Cover (MLCCS) Acres: 32.60 (figure 2).

Total Semi-Natural Land Cover (MLCCS) Acres: 5.30 (figure 2).

Total Natural Community Remnant Land Cover (MLCCS) Acres: 22.10 (figure 2).

The MLCCS inventory identified ten different land cover types within this area: the eight cultural land cover types include short grasses and mixed trees with 4-10% impervious cover, short grasses with 11-25% impervious cover, box elder and green ash with 11-25% cover, 51-75% impervious cover with deciduous trees, pavement with 91-100% impervious cover, 26-50% impervious cover with deciduous trees, short grasses and mixed trees with 26-50% impervious surfaces, and 11-25% cover with deciduous trees. Cultural land cover types within this secondary area total 32.6 acres. Cultural land cover types are located within residential landscapes along the boulevard area and in the parkland along the river bottoms and bluffs. Two semi-natural land cover types were recorded in the secondary area, these being box elder/green ash disturbed forest, 3.7 acres, and Midwest dry limestone/dolostone dry cliff, 1.6 acres. Two natural community land cover types were identified in this secondary area, including mesic oak forest, 7.6 acres, and three fragmented floodplain forest remnants, 14.5 acres collectively.

#### Reference:

Leete, P., B. Richardson, and E. Perry, May 2000. *Minnesota Land Cover Classification System Training Manual Version 4.0*. Minnesota Department of Natural Resources.

**Figure 3 – Inventory of Natural Community Remnants & Noteworthy Features**

## **A2. Detailed Inventory of Natural Community Remnants and Noteworthy Features in the Project Area**

A detailed inventory of remaining natural communities was conducted within the seven priority and secondary areas of the Mississippi Bluff project area (297.38 acres). The results of this inventory are summarized on Figure 3. This inventory provides additional detail to the Minnesota Land Cover Classification System (MLCCS) inventory described in the preceding section. The minimum mapping unit under the MLCCS methodology is 1 acre for natural communities and 2 acres for cultural and developed landscapes. The detailed field inventory included areas of natural vegetation or noteworthy features that were .25 acres and larger.

**Previous inventories.** The Minnesota County Biological Survey's (MCBS) 1994 county wide survey of Ramsey County mapped most of the forested bluff of the Mississippi Bluff project area as oak forest (subtype undetermined). No other natural community types were mapped within the project area by the MCBS.

The MLCCS inventory determined that approximately 124 acres of the 297.38-acre Mississippi Bluff project area was identified as natural community remnant vegetation of varying quality and size. Areas classified as Cottonwood Floodplain Forest, Silver Maple Floodplain Forest, Maple-Basswood Forest and Mesic Oak Forest were inventoried in detail. When conducting inventories of remaining natural communities, factors such as size of the remnant, past disturbance and land use history, presence/absence of noxious or invasive species, native species diversity, and current land use were considered. Meander searches were conducted for rare species (federally or state-listed) and noteworthy species (such as spring ephemeral or woodland wildflowers).

Cultural and developed land cover areas (such as parking and other impervious areas, lawns, or highly disturbed woodland and forest areas) were not inventoried in detail. However, general observations (such as erosion, invasive plant species, weed species, maintenance practices, stormwater impacts, etc.) were recorded for cultural and developed land cover areas, and are included in the text descriptions of each priority and secondary area.

Smaller areas of noteworthy vegetation or natural features that were not mapped by the original land cover inventory of the project area are included in this figure. These areas are generally less than 1 acre and greater than .25 acres, as requested by the City of Saint Paul Department of Parks and Recreation. Such areas include exposed dry limestone bluffs, small maple/basswood ravines, and groundwater seep areas and associated perched wetlands.

**Summary of Findings.** Mesic oak forest and floodplain forest are the most prolific natural community types identified in the inventory of the project area, comprising 60.9 acres and 52.9 acres, respectively. Maple basswood forest comprised 10.4 acres within moist, cool ravines along the bluff, the largest of these remnants occurring within the Shadow Falls ravine. The remaining 173 acres of the project area consists of cultural landscape types (such as residential areas and college campuses, streets, boulevards, and turf grass park areas) and semi-natural vegetation (such as disturbed deciduous forest and disturbed deciduous woodland).

At least two natural communities stand out as higher quality than the majority of the others. These higher quality communities are the maple basswood forest remnant within the Shadow Falls Priority Area and Desnoyer Park Priority Area, and the floodplain forest remnant in the Ford Plant Secondary Area. These natural community remnants have retained many of their ecological functions and natural components despite drastic alteration of their surrounding landscape, and will likely require fewer resources to restore them to ecological health than the other remnants in the project area. The mesic oak forest remnants that occur throughout the entire project area have experienced a wide range of past land use impacts and degradation and will require varying levels of management resources to restore them to ecological health.

No federally or state-listed vascular plant species were found during the 2000 field surveys. When encountered, noteworthy native species (e.g., native wildflowers) are mentioned in the detailed descriptions of individual natural community remnants. There are three historic records from the early 1900s of two rare plant species within, or immediately adjacent to the Mississippi River Bluff project area. These include two records of handsome sedge (*Carex formosa*), and one record of plantain-leaved sedge (*Carex plantaginea*). Field inventory efforts in 2000 were unsuccessful at rediscovering such species. Although these species may have persisted along the Mississippi River Valley of Saint Paul in the early 1900s, habitat degradation from land use practices, fire suppression, and manipulation of river water levels have likely lead to the extirpation of such species from the project area.

**Spring Ephemeral Inventory.** In Spring 2001, an inventory of spring ephemeral flora was completed in the priority project areas--Desnoyer Park, Shadow Falls, Goodrich to Randolph and Randolph to Ford Parkway areas. Spring ephemerals are ground layer plants typical of deciduous woodlands that flower in early spring, before the leaf canopy has opened (typically April to early May). The results of the inventory are discussed in the appropriate sections that follow.

## **Detailed Inventory Results by Project Area**

The following are detailed descriptions of the natural communities found within each of the seven priority and secondary areas. These descriptions are organized by the seven priority and secondary areas and include the following information: size (in acres) of the area, detailed descriptions of the natural communities and noteworthy features occurring the areas, and other ecological notes. The priority and secondary areas are presented here in successive order from north to south, and relate to Figures 1 through 4.

### **Desnoyer Park Priority Area (20.40 acres):**

In this priority area the MLCCS identified one natural community remnant consisting of mesic oak forest. The field inventory of the Desnoyer Park Priority Area revealed several additional noteworthy natural features: a narrow band of floodplain forest, a perennial seep area with a perched wetland, diverse spring ephemeral populations, and two degraded maple basswood ravines (Figure 4).

The following text describes the detailed inventory of the natural community remnants and noteworthy natural features inventoried within the Desnoyer Park Priority Area.

### ***Natural Community Remnant***

#### Mesic Oak Forest Remnant (5.10 acres):

The mesic oak forest remnant is moderately to highly disturbed by past land use practices and lack of management to control exotic invasive species. The canopy is comprised of bur oak (*Quercus macrocarpa*) and red oak (*Q. rubra*). Other canopy species include basswood (*Tilia americana*), American elm (*Ulmus americana*), hackberry (*Celtis occidentalis*), and scattered sugar maple (*Acer saccharum*). Common buckthorn is dense in portions of the understory and ground layers, resulting in a sparse native shrub and herbaceous layer. Summer herbaceous species observed include white snakeroot (*Eupatorium rugosum*), woodland sedge (*Carex blanda*), Pennsylvania sedge (*C. pennsylvanica*), moonseed (*Menispermum canadense*), carrion flower (*Smilax herbacea*), bristly greenbrier (*S. hispida*), nightshade (*Solanum dulcamara*), heart-leaved aster (*Aster cordifolius*), false Solomon's seal (*Smilacina racemosa*), and zigzag goldenrod (*Solidago flexicaulis*).

### ***Noteworthy Features***

#### Degraded Floodplain Forest Remnant:

A small floodplain forest remnant, approximately 30 to 40 meters wide, exists at the base of the bluff below the mesic oak forest remnant. The soils are seasonally-flooded sandy alluvial material. Dominant canopy species include silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), and box elder (*Acer negundo*). Common buckthorn (*Rhamnus cathartica*) is abundant in the understory, along with red osier dogwood (*Cornus sericea*). Reed canary grass (*Phalaris arundinacea*) and switchgrass (*Panicum virgatum*) are the common species within the herbaceous layer.

#### Spring Ephemeral Flora:

The Desnoyer Park area was found to have the most diverse and healthy populations of native spring ephemeral flora among the four priority areas, particularly in the area north of Pelham Avenue. The area includes some sizeable colonies of some ephemeral species, such as wild ginger (*Asarum canadense*) and bellwort (*Uvularia grandiflora*) on relatively flat areas toward the top of the slopes. Other species are found in groups of 5-30 plants on the flat areas and steeper slopes. Vegetation on the steeper slopes was more sparse, but still includes a variety of ephemeral species.

Plant species noted in the May, 2001 inventory include the following: wild ginger (*Asarum canadense*), false solomon's seal (*Smilacina racemosa*), nodding trillium (*Trillium cernuum*), jack-in-the-pulpit (*Arisaema triphyllum*), bellwort (*Uvularia grandiflora*), bloodroot (*Sanguinaria canadensis*), wild geranium (*Geranium maculatum*), wood anemone (*Anemone quinquefolia*), wild sasparilla, early meadow

rue (*Thalictrum dioicum*), and Virginia waterleaf (*Hydrophyllum virginianum*). Also noted in the survey were large patches of Pennsylvania sedge (*Carex pennsylvanica*).

#### Perennial Seep and Perched Wetland:

The wetland has a mix of exotic and native herbaceous and woody species. Native herbaceous species observed in this wetland include spike rush (*Eleocharis palustris*), Canada rush (*Juncus canadensis*), swamp milkweed (*Asclepias incarnata*), American water horehound (*Lycopus americanus*), spotted touch-me-not (*Impatiens capensis*), fox sedge (*Carex vulpinoidea*), Bebb's sedge (*Carex bebbii*), a species of bulrush (*Scirpus atrovirens*), Canada wild-rye (*Elymus canadensis*), willow herb (*Epilobium sp.*), blue vervain (*Verbena hastata*), narrow-leaved cattail (*Typha angustifolia*), and ironweed (*Vernonia fasciculata*). Native shrubs observed along the edges of the seep include gray dogwood (*Cornus racemosa*), sandbar willow (*Salix exigua*), red cedar (*Juniperus virginiana*), and staghorn sumac (*Rhus typhina*).

Problematic invasive and exotic species within this seep area include common buckthorn (*Rhamnus cathartica*), Tartarian honeysuckle (*Lonicera tatarica*), Siberian elm (*Ulmus sibirica*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), Kentucky bluegrass (*Poa pratensis*), orchard grass (*Dactylis glomerata*), and yellow and white sweet clover (*Melilotus officinalis* and *Melilotus alba*). Narrow leaved cattail may need to be managed as well, as it is not likely a native component of this wetland type. Shrubs and trees (both native and exotic) are encroaching into the saturated seep area, shading out herbaceous wet meadow species. The groundwater seep hydrology appears to be intact, providing a saturated soil substrate throughout the year. Despite a high coverage of invasive species and past land use degradation, this seep area presents an opportunity to improve and restore a unique natural feature within the Mississippi Bluff project area.

#### Degraded Maple Basswood Ravines:

Two moist ravines were encountered during an inventory of the mesic oak forest. Although quite small and degraded by past land use practices, these ravines support mesic forest canopy species such as sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and hackberry (*Celtis occidentalis*).

The northern ravine has a perennial, ground water fed stream flowing beneath a constructed concrete retaining wall. The ravine has been divided by the construction of Mississippi River Boulevard, with a small segment of the ravine still persisting on the eastern side of the road within a residential landscape. The dominant tree canopy species include basswood (*Tilia americana*), sugar maple (*Acer saccharum*), and American elm (*Ulmus americana*), with scattered box elder and green ash. Common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) are present in small numbers within the ravine. The steep side slopes of the ravine have a sparse herbaceous layer comprised of heart-leaved aster (*Aster cordifolius*), false Solomon's seal (*Smilacina racemosa*), and zigzag goldenrod (*Solidago flexicaulis*), with small patches of wild ginger (*Asarum canadense*), a noteworthy spring-blooming wildflower species. Herbaceous species along the stream bank include

spotted touch-me-not (*Impatiens capensis*) and nightshade (*Solanum dulcamara*). Grape vines (*Vitis riparia*) are present as well.

The southern ravine is segmented by Mississippi River Boulevard. The stream within the southern ravine appears to have been cut off by the roadbed, as evident by water ponded on the east side of the road and no flowing water within the stream channel on the west side. The dominant tree canopy species within this ravine are cottonwood (*Populus deltoides*), hackberry (*Celtis occidentalis*), and box elder (*Acer negundo*). Tartarian honeysuckle (*Lonicera tatarica*) is abundant throughout the ravine, along with scattered common buckthorn (*Rhamnus cathartica*). Common herbaceous species are zigzag goldenrod (*Solidago flexicaulis*) and gooseberry (*Ribes* sp.), with no evidence of characteristic spring ephemeral wildflowers observed.

***Other Ecological Notes:***

Russian olive (*Elaeagnus angustifolia*) was observed growing within a stormwater treatment swale on the east side of Mississippi River Boulevard, north of the Lake Street Bridge. This species is also establishing along the disturbed woodland edge on the west side of the boulevard. Russian olive can be an aggressive colonizer of disturbed areas, and this species should be monitored and/or removed from these areas to prevent further invasion and establishment within adjacent natural areas on the bluff.

**Summary of Management Issues: Desnoyer Park Priority Area**

- **Control invasive exotic species in woodland and seep areas.**
- **Protect and enhance spring ephemeral flora populations.**
- **Control Russian olive in storm water swale.**

**Shadow Falls Priority Area (36.10 acres):**

The most ecologically significant land cover area within the Shadow Falls Priority Area is the maple basswood forest remnant in the moist cool ravine of Shadow Falls. This natural community remnant is likely the highest quality example of natural vegetation within the project area. Maple basswood forest is now considered an uncommon natural forest community in the Minneapolis/Saint Paul Metropolitan Area, although it was once an important component of the pre-European settlement landscape. Unlike the more common forest communities, such as mesic oak forest and floodplain forest, present day maple basswood forest remnants are often restricted to moist, shaded ravines with steep side slopes, where past logging and deleterious land use practices were restricted. Smaller, lower-quality examples of maple basswood forest occur throughout the Mississippi Bluffs project area (e.g., Desnoyer Priority Area), but these are quite small and degraded, and are less likely to regain their natural structure and function as a viable natural community due to past disturbance, high edge effect, and current landscape fragmentation.

Other natural communities mapped by the MLCCS inventory include mesic oak forest remnants to the north and south of the maple basswood forest. Within these oak forest remnants are dry limestone bluff outcrops that were not mapped by the MLCCS inventory, but were identified by more detailed field inventory of this priority area. These dry outcrops are not dominated by natural vegetation and are highly eroded and otherwise degraded by the high number of park visitors that use the outcrops as river viewing areas. The outcrops were noted because they do support a small component of remnant dry prairie species, and represent opportunities for restoring dry prairie vegetation to these areas. Two large rock outcrops and two small dry eroding knolls were mapped and inventoried. In addition, a small, degraded maple basswood ravine was mapped and inventoried west of the Saint Thomas campus at the south end of the priority area (figure 3).

The following text describes the detailed inventory of natural community remnants and noteworthy features within the Shadow Falls Priority Area.

### ***Natural Community Remnants***

#### Maple Basswood Forest (6.20 acres):

The maple basswood forest remnant is likely the highest quality natural community remnant within the project area. The ravine has a perennially flowing spring-fed stream, steep side slopes, and a pronounced limestone waterfall. Several narrow trails meander along the stream and waterfall throughout the upper elevations of the ravine. One large stormwater pipe was documented within the upper reaches of the ravine, and is creating an eroded gully. This maple basswood forest remnant appears to have been selectively logged in the past, its structure having been heavily altered by past land use practices. Nonetheless the community appears to be in good condition and is regenerating native canopy and sub-canopy species.

The dominant canopy species are sugar maple (*Acer saccharum*), basswood (*Tilia americana*), with scattered bur oak (*Quercus macrocarpa*), northern pin oak (*Q. ellipsoidalis*), hackberry (*Celtis occidentalis*), and scattered walnut (*Juglans cinerea*). Sub-canopy species include pagoda dogwood (*Cornus alternifolia*), leatherwood (*Dirca palustris*), red osier dogwood (*Cornus sericea*), choke cherry (*Prunus virginiana*), and scattered paper birch (*Betula papyrifera*). Although common buckthorn is still present within the understory and ground layer, significant clearing of buckthorn saplings and seedlings has occurred over the past two years.

The herbaceous layer has a significant spring wildflower component that includes native species such as nodding trillium (*Trillium cernuum*), Jack-in-the-pulpit (*Arisaema triphyllum*), liverleaf (*Hepatica acutiloba*), spring beauty (*Claytonia virginica*), wild ginger (*Asarum canadense*), Dutchman's britches (*Dicentra canadensis*), large-flowered bellwort (*Uvularia grandiflora*). These species tend not to persist in other areas along the bluff that were highly disturbed in the past and/or are presently disturbed, eroded, compacted, or choked out with dense stands of common buckthorn (*Rhamnus cathartica*) or Tartarian honeysuckle (*Lonicera tatarica*). Other common herbaceous species observed in the forest ground layer

include woodland sedge (*Carex blanda*), Pennsylvania sedge (*Carex pensylvanica*), a species of sedge (*Carex eburnea*), false Solomon's seal (*Smilacina racemosa*), heart-leaved aster (*Aster cordifolius*), zigzag goldenrod (*Solidago flexicaulis*), carrion flower (*Smilax herbacea*), moonseed (*Menispermum canadense*), tick trefoil (*Desmodium glutinosum*), and early meadow rue (*Thalictrum dioicum*). These species are scattered in relatively small patches throughout the Shadow Falls priority area. A single colony of swamp buttercup (*Ranunculus septentrionalis*) was also noted along a small stream south of Marshall Avenue.

The area between Marshall Avenue and the Shadow Falls ravine also includes some patches of the same species of spring ephemerals noted in the Shadow Falls and Desnoyer Park areas, as well as other native ground cover species. The ground cover is not as diverse as the Desnoyer Park area north of Pelham, and includes patches of crown vetch and brome grass.

Common buckthorn, Tartarian honeysuckle, and other non-native invasive or noxious species, such as burdock (*Arctium minus*), prickly ash (*Zanthoxylum americanum*), motherwort (*Leonurus cardiaca*), and smooth brome (*Bromus inermis*), are aggressively establishing and persisting along the forest edge, especially on flat bluff tops that are currently maintained as turf lawn. These exposed edges are very susceptible to re-invasion of weedy aggressive species, and revegetation of these narrow bands of turf to native canopy and herbaceous species may be desirable to limit re-invasion of buckthorn and honeysuckle once they are removed.

#### Mesic Oak Forest (11.3 acres):

##### North Remnant:

The canopy of this mesic oak forest remnant is comprised of bur oak (*Quercus macrocarpa*), red oak (*Quercus rubra*), and sugar maple (*Acer saccharum*). The canopy is open in places, allowing for establishment of dense stands of native shrubs, such as gray dogwood (*Cornus racemosa*) and staghorn sumac (*Rhus typhina*), as well as establishment of exotic shrub species such as common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*). American hornbeam (*Ostrya virginiana*) is the dominant understory tree. Sugar maple and oak regeneration is high. Native herbaceous understory species are restricted to areas free of a dense shrub layer, and include zigzag goldenrod (*Solidago flexicaulis*), heart-leaved aster (*Aster cordifolius*), Pennsylvania sedge (*Carex pensylvanica*), a species of sedge (*Carex eburnea*), carrion flower (*Smilax herbacea*), hairy sunflower (*Helianthus hirsutus*), golden alexander (*Zizia aurea*), and tick trefoil (*Desmodium glutinosum*). The remnant is degraded in places by road fill, soil compaction, and erosion caused by runoff and pedestrian trail use. Crown vetch (*Coronilla varia*), a problematic exotic species, is invading the forest edge along an area of past road construction and fill.

Within this oak forest remnant are several very small dry rock knolls that are used by pedestrians as river viewing areas (figure 3). Although these knolls are eroding and

compacted by over use, they support several dry prairie species. These include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), mountain mint (*Pycnanthemum virginianum*), and wolfberry (*Symphoricarpos occidentalis*). Several weed species persist on these knolls, such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and white and yellow sweet clover (*Melilotus officinalis* and *M. alba*). These small dry knolls could be managed, expanded, and restored to dry prairie vegetation, but would require soil amendments, erosion control, and occasional prescribed burns.

#### South Remnant:

The canopy of this mesic oak forest remnant is comprised mostly of red oak (*Quercus rubra*) and bur oak (*Q. macrocarpa*), with occasional sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and hackberry (*Celtis occidentalis*). American hornbeam (*Ostrya virginiana*) is the dominant understory tree. The shrub layer is dense in numerous sunny exposed openings within the tree canopy, and includes gray dogwood (*Cornus racemosa*), downy arrow-wood (*Viburnum rafinesquianum*), and staghorn sumac (*Rhus typhina*). Common buckthorn and Tartarian honeysuckle were more abundant prior to volunteer and crew removals that took place during the 2000 field season. The herbaceous layer is fragmented and restricted to sunny areas. The herbaceous layer includes Pennsylvania sedge (*Carex pensylvanica*), woodland sedge (*C. blanda*), Sprengell's sedge (*Carex sprengelii*), a species of sedge (*Carex albursina*), zigzag goldenrod (*Solidago flexicaulis*), Canada goldenrod (*Solidago canadensis*), carrion flower (*Smilax herbacea*), mountain mint (*Pycnanthemum virginianum*), Canada tick trefoil (*Desmodium canadense*), poison ivy (*Toxicodendron radicans*), and hairy sunflower (*Helianthus hirsutus*). The upper portions of this remnant are eroded due to trails and high pedestrian use. Several dry knolls occur along the bluff edge and have similar native prairie and weedy species as the knolls of the northern mesic oak forest remnant described above (see figure 3 for locations).

#### ***Noteworthy Features***

##### Dry Eroding Limestone and Sandstone Outcrops:

On both the north and south bluffs at the mouth of the maple basswood ravine are two large areas of dry, eroding limestone and sandstone outcrops. These outcrops are severely impacted by pedestrian traffic, causing severe erosion and the formation of large gullies. Native dry prairie species were observed on both outcrops, including Indian grass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), mountain mint (*Pycnanthemum virginianum*), and goldenrod (*Solidago* spp.). However, several non-native invasive species were also present, such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), white sweet clover (*Melilotus alba*), and yellow sweet clover (*M. officinalis*). Due to fire suppression and lack of management, these dry outcrops are also being invaded by native and non-native shrub species, such as common buckthorn, Tartarian honeysuckle, prairie rose (*Rosa arkansana*), staghorn sumac (*Rhus typhina*), red cedar (*Juniperus virginiana*), poison ivy (*Toxicodendron*

*radicans*), American bittersweet (*Celastrus scandens*), and American hornbeam (*Ostrya virginiana*).

These dry limestone/sandstone outcrops present an opportunity to reestablish small dry prairie patches to these natural overlooks. However, significant resources will be necessary to reestablish soil, control erosion, revegetate with native dry prairie species, limit pedestrian traffic, and manage such areas with prescribed burning and or other methods.

#### Degraded Maple Basswood Ravine:

This ravine is very degraded from past bridge construction and stormwater impacts. The vegetation is a mix of maple basswood forest species and disturbed deciduous forest species. The canopy is comprised of limited sugar maple (*Acer saccharum*) and basswood (*Tilia americana*), paper birch (*Betula papyrifera*) and several other atypical species comprising the remainder of the canopy, such as hackberry (*Celtis occidentalis*), box elder (*Acer negundo*), and cottonwood (*Populus deltoides*). The ravine side slopes are very eroded and sparsely vegetated with herbaceous species, such as zigzag goldenrod (*Solidago flexicaulis*), false Solomon's seal (*Smilacina racemosa*), and early meadow rue (*Thalictrum dioicum*). Common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) are established within the ravine.

#### Summary of Management Issues: Shadow Falls Priority Area

- **Control invasive exotic species in woodland.**
- **Control erosion at limestone bluff outcrops.**
- **Manage exotics along turf edge of woodland.**
- **Close informal trails and restore vegetation.**

#### Goodrich to Randolph Priority Area (25.30 acres):

Mesic oak forest is the only significant natural community remnant identified by the MLCCS inventory in this priority area. A small, degraded floodplain forest remnant also remains within the floodplain of the priority area.

The following text describes the detailed inventory of natural community remnants and noteworthy features within the Goodrich to Randolph Priority Area:

#### *Natural Community Remnants*

##### Mesic Oak Forest (16.50 acres):

This mesic oak forest remnant is a continuation of the oak forest remnant in the southern portion of the Shadow Falls Priority Area, and is similar in many regards. The topography is gradually sloping along the upper half of the bluff and then drops off abruptly. A footpath follows this drop off, and is causing increased erosion at many points along the bluff edge (figure 9). Invasion of common buckthorn

(*Rhamnus cathartica*) is relatively low at the northern end of this remnant, but increases at the southern end. The canopy species include red oak (*Quercus rubra*), bur oak (*Q. macrocarpa*), basswood (*Tilia americana*), and sugar maple (*Acer saccharum*). Gray dogwood (*Cornus racemosa*), red dogwood (*Cornus sericea*), downy arrow-wood (*Viburnum rafinesquianum*), and American hornbeam (*Ostrya virginiana*) are common in the understory. Several native species were observed in the herbaceous layer, including heart-leaved aster (*Aster cordifolius*), false Solomon's seal (*Smilacina racemosa*), zigzag goldenrod (*Solidago flexicaulis*), Virginia water leaf (*Hydrophyllum virginiana*), liverleaf (*Hepatica acutiloba*), woodland sedge (*Carex blanda*), Pennsylvania sedge (*Carex pennsylvanica*), and hairy sunflower (*Helianthus hirsutus*). No spring ephemeral species were noted in this area.

A small but significant stand of white oak (*Quercus alba*) was noted at the overlook area at the intersection of St. Clair and Mississippi River Boulevard. A stand of several mature white oak persist on the bluff edge at this overlook area. The understory appears to have been cleared in the past to provide views from the bench. Gray dogwood (*Cornus racemosa*) and white oak seedlings are reestablishing the maintained slope, with relatively little buckthorn or honeysuckle establishment.

### ***Noteworthy Features***

#### **Degraded Floodplain Forest:**

This small floodplain remnant is located at the base of the bluff below the mesic oak forest. This degraded remnant occurs on seasonally flooded sandy alluvial soils. The vegetation within this remnant is predominantly young, second growth silver maple (*Acer saccharinum*) and cottonwood (*Populus deltoides*) and willow species (*Salix* spp.) forming an open canopy. Common buckthorn (*Rhamnus cathartica*) is common in the understory, along with gray dogwood (*Cornus racemosa*) and red dogwood (*Cornus sericea*). Tartarian honeysuckle (*Lonicera tatarica*) is scattered along the drier edges of the forest. The herbaceous layer is a mix of native and non-native, weedy species, including slough sedge (*Carex atherodes*), Canada goldenrod (*Solidago canadensis*), Canada wild rye (*Elymus canadensis*), clearweed (*Pilea pumila*), woodland sedge (*Carex blanda*), nightshade (*Solanum dulcamara*), and spotted touch-me-not (*Impatiens capensis*). Purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*), two problematic invasive species are present in small numbers. A non-native tree, Southern catalpa (*Catalpa bignonioides*) is also present. Beaver activity has removed several medium sized cottonwood and silver maple trees.

### **Summary of Management Issues: Goodrich to Randolph Priority Area**

- **Control invasive exotic species.**
- **Control erosion from informal paths or close paths.**

### **Randolph to Ford Parkway Priority and Secondary Areas (27.60 acres):**

Three natural community remnants are identified by the MLCCS inventory for this area: maple basswood forest, silver maple floodplain forest and mesic oak forest. In addition to the natural communities identified by the MLCCS inventory the detailed inventory of this area also revealed a dry, eroding limestone/sandstone bluff with native dry prairie species (Figure 3).

A portion of these areas is owned by the Ford Motor Company. This property was not included in the initial efforts to clear exotic species during 2000-2001. The City should work with the Ford Company to encourage elimination of exotic species on their property, as its presence will affect the managed portions of the bluffs. If Ford no longer needs this area in the future the City should consider purchase of this portion of the bluffs.

The following text describes the detailed inventory of natural community remnants and noteworthy features within the Randolph to Ford Parkway Priority and Secondary Areas:

#### ***Natural Community Remnants***

##### **Maple Basswood Forest (4.20 acres):**

This maple basswood forest remnant occurs as a thin strip along the lower elevations of the bluffs. The slopes are steep and the soils are exposed, rocky and eroded. The canopy is mostly comprised of sugar maple (*Acer saccharum*), with scattered basswood (*Tilia americana*), red and bur oak (*Quercus rubra* and *Q. macrocarpa*), and hackberry (*Celtis occidentalis*). A few stressed paper birch (*Betula papyrifera*) were observed in the understory. Common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) are present, but not abundant, through most of the forest remnant. The herbaceous layer is comprised of very few species, such as woodland sedge (*Carex blanda*), Pennsylvania sedge (*Carex pennsylvanica*), heart-leaved aster (*Aster cordifolius*) and zigzag goldenrod (*Solidago flexicaulis*).

##### **Silver Maple Floodplain Forest (3.90 acres):**

The silver maple floodplain forest remnant is a thin strip of floodplain within the river bottoms. The northern extent of the floodplain has few mature silver maple (*Acer saccharinum*) and cottonwood (*Populus deltoides*) trees, and is open to invasion by common buckthorn (*Rhamnus cathartica*). However, the southern end of the remnant has a mature stand of silver maple, cottonwood, black willow (*Salix nigra*), and American elm (*Ulmus americana*). Within the open canopy areas of the remnant, buckthorn, red osier dogwood (*Cornus sericea*), and sandbar willow (*Salix exigua*) exist in dense stands. Herbaceous species persist in disturbed, seasonally flooded meadows along the river edge and within canopy openings. Herbaceous species observed within this remnant include slough sedge (*Carex atherodes*), Canada wild rye (*Elymus canadensis*), reed canary grass (*Phalaris arundinacea*), burdock (*Arctium minus*), spotted touch-me-not (*Impatiens capensis*), nightshade (*Solanum dulcamara*), nodding bur marigold (*Bidens cernua*), and several species of smartweed

(*Polygonum pensylvanicum*, *P. persicaria*, and *P. lapathifolium*). At the southern end of the floodplain, the forest extends into a pronounced ravine. Within the lowland portion of the ravine, several vernal pools exist, providing important habitat to breeding amphibians and migratory birds in the spring. Beaver activity is evident within the floodplain forest stand. Several medium to large cottonwood and silver maple trees were recently downed by beaver at the time of the survey.

#### Mesic Oak Forest (6.20 acres)

##### North Remnant:

The northern oak forest remnant is a continuation of the mesic oak forest remnant within the Goodrich to Randolph Priority Area. The oak forest vegetation occurs on the flat wooded bluff tops between the lawn areas and the maple basswood forest ravine. The dominant canopy species are red oak (*Quercus rubra*), bur oak (*Quercus macrocarpa*), with occasional hackberry (*Celtis occidentalis*), basswood (*Tilia americana*), and sugar maple (*Acer saccharinum*). The understory species include gray dogwood (*Cornus racemosa*), red osier dogwood (*Cornus sericea*), downy arrow-wood (*Viburnum rafinesquianum*), and choke cherry (*Prunus virginiana*).

Common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) are relatively sparse throughout this forest remnant. However, these species are abundant along exposed forest edges and steep eroding bluff faces. Herbaceous species observed within this mesic oak forest remnant include liverleaf (*Hepatica acutiloba*), Virginia water leaf (*Hydrophyllum virginianum*), Pennsylvania sedge (*Carex pensylvanica*), woodland sedge (*C. blanda*), Sprengell's sedge (*Carex sprengelii*), a species of sedge (*Carex albursina*), hairy sunflower (*Helianthus hirsutus*), zigzag goldenrod (*Solidago flexicaulis*), Canada goldenrod (*Solidago canadensis*), carrion flower (*Smilax herbacea*), mountain mint (*Pycnanthemum virginianum*), poison ivy (*Toxicodendron radicans*), white snakeroot (*Eupatorium rugosum*), and burdock (*Arctium minus*).

The spring ephemerals field survey identified a few small patches of species including large-flowered bellwort (*Uvularia grandiflora*), wild geranium (*Geranium maculatum*), early meadow rue (*Thalictrum dioicum*), golden alexanders (*Zizia cordata*), hepatica (*Hepatica acutiloba*), false rue anemone (*Isopyrum biternatum*), wild ginger (*Asarum canadense*), and one small group of bloodroot (*Sanguinaria canadensis*). All of the patches were small and widely scattered through the area. Much of the ground is bare in this area, or is dominated by vines or small shrubs.

A male pileated woodpecker (*Dryocopus pileatus*) was observed while conducting survey work within this mesic forest community.

##### South Remnant:

This mesic oak forest remnant occurs on very steep slopes, with only a small portion extending up onto the flatter bluff tops, and made access for field survey challenging. The canopy is dominated by red and bur oak (*Quercus rubra* and *Q. macrocarpa*), with occasional hackberry (*Celtis occidentalis*), and basswood (*Tilia americana*). The shrub understory has gray dogwood (*Cornus racemosa*) and downy arrow-wood

(*Viburnum rafinesquianum*) with scattered common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) established in patches along the exposed forest edges. American hornbeam (*Ostrya virginiana*) is present as an understory tree species. The herbaceous layer was sparse along the southern extent of the remnant (just north of the Ford Bridge), and several herbaceous weed species were common along the lawn/forest edges. These include burdock (*Arctium minus*), white and yellow sweet clover (*Melilotus alba* and *M. officinalis*), and motherwort (*Leonurus cardiaca*). No spring ephemeral species were noted in this area.

### ***Noteworthy Features***

#### **Dry Eroding Limestone/Sandstone Outcrop:**

This eroding bluff is located at the southern mouth of a wide natural ravine near the southern end of Randolph to Ford Parkway Priority and Secondary Area. On the north facing side of the bluff, several small paper birch (*Betula papyrifera*) were observed. The dry, west and southwest facing portions of the outcrop are heavily impacted and eroded from pedestrian traffic. Graffiti is painted on the rocks. Unlike other dry rock outcrops encountered in the project area, this outcrop has very few native dry prairie species persisting on it. The few native species that were observed include little bluestem (*Schizachyrium scoparium*), side oats grama (*Bouteloua curtipendula*), and Indian grass (*Sorghastrum nutans*). However, this dry rock outcrop could support dry prairie vegetation with soil amendments, erosion control, and reduced pedestrian access.

### **Summary of Management Issues: Randolph to Ford Parkway Areas**

- **Control invasive exotic species.**
- **Control erosion at limestone bluff outcrops**

### **Ford Plant Secondary Area (79.0 acres):**

Floodplain forest and mesic oak forest were the two natural community remnants identified by the MLCCS inventory for this secondary area. The field inventory did not find any additional natural community types or noteworthy features within this secondary area. However, the detailed inventory did slightly adjust the boundary between two land cover types, and identified an area of severe erosion and degradation within the northern mesic oak forest remnant south of the Ford Bridge (figure 3, figure 9).

The following text describes the detailed inventory of natural community remnants within the Ford Plant Secondary Area:

### ***Natural Community Remnants***

#### **Floodplain Forest (28.9 acres):**

The floodplain forest in the southeastern corner is in very good condition, considering its urban context and close proximity to the Ford Plant facilities and managed Hidden Falls park area. Like the maple basswood forest remnant in Shadow Falls, this forest is one of the highest quality remnants within the Mississippi Bluff project area. This floodplain forest benefits from annual inundation, as it is hydrologically connected to the Mississippi River by the Hidden Falls Creek. From hydrologic indicators observed in the field, it appears as though this floodplain is annually flooded via the creek channel, which backs up during spring flood events. The soils are seasonally flooded sandy alluvium. Several backwater channels are evident within the floodplain remnant, which provide valuable wildlife habitat for spring migratory birds and breeding grounds for several amphibian species. Numerous American toads (*Bufo americanus*) were observed under the large downed and rotting logs that are common along the forest floor.

The canopy of the floodplain forest is comprised mostly of silver maple (*Acer saccharinum*). Cottonwood (*Populus deltoides*), hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), and box elder (*Acer negundo*) are occasional through the over story, and more abundant along the forest edges and river bank. Common buckthorn (*Rhamnus cathartica*) is not abundant within the forest interior, and occasional along the exposed edges. Common mulberry (*Morus alba*) is present along sunny edges as well. Silver maple and cottonwood seedlings and saplings comprise much of the forest understory. The herbaceous layer is comprised of many characteristic native species, including wood nettle (*Laportea canadensis*), spotted and pale touch-me-not (*Impatiens capensis* and *I. pallida*), Virginia water leaf (*Hydrophyllum virginiana*), and rice cut grass (*Leersia oryzoides*). The herbaceous layer along the disturbed edges includes several undesirable noxious species, including garlic mustard (*Alliaria petiolata*), creeping Charlie (*Glechoma hederacea*), and motherwort (*Leonurus cardiaca*).

#### Mesic Oak Forest (9.50 acres):

##### North Remnant:

The mesic oak forest at the north end of this area occurs on a very steep bluff south of the Ford Parkway Bridge and North of the Ford Dam facilities. This remnant was difficult to inventory due to a chain link fence restricting access and steep, eroding slopes.

The canopy is predominantly red oak (*Quercus rubra*) and bur oak (*Q. macrocarpa*). The understory is comprised of American hornbeam (*Ostrya virginiana*), with occasional clumps of staghorn sumac (*Rhus typhina*) and gray dogwood (*Cornus racemosa*) in understory openings. Common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) are present in highest numbers along forest edges, canopy openings, and degraded areas associated with the bridge and dam facility construction.

##### South Remnant:

The southern mesic oak forest remnant is very degraded. Although the forest has typical canopy species (northern pin oak and bur oak), the understory is very infested with common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*). These two invasive shrub species form very dense stands along the base of the Hidden Falls overlook, shading out most of the herbaceous understory species. In less shaded areas, shrub species include gray dogwood (*Cornus racemosa*) and downy arrow-wood (*Viburnum rafinesquianum*). Herbaceous species in these areas include woodland sedge (*Carex blanda*), motherwort (*Leonurus cardiaca*), white snakeroot (*Eupatorium rugosum*), nightshade (*Solanum dulcamara*), burdock (*Arctium minus*), and garlic mustard (*Alliaria petiolata*). The soils within this forest unit appear to be very disturbed and eroded by past land use practices and possible road and dam facility construction. The bluff area immediately below the Hidden Falls overlook is particularly degraded, with increased erosion caused by tree removal for views, vegetation trampling and soil compaction by park users, and erosion from storm water runoff. Soil erosion and trampling are also problems within the Hidden Falls ravine as well.

#### ***Other Ecological Notes:***

The Ford trailer parking area (known as the “Bullpen”) is a large area of fill in a historic floodplain area. The Bullpen is a large impervious area used for parking tractor trailers and for equipment storage. The south facing slope of the fill pad is eroding into the floodplain forest remnant to the south. A large gully has formed on this slope from storm water runoff. The slope consists of vegetation with numerous weed species that are invading the edge of the floodplain forest.

The overlook area above the Hidden Falls ravine is eroded from heavy pedestrian use. The woodlands along this slope are overrun with a dense stand of common buckthorn. Within the designed overlook area itself, several of the non-native Norway maples (*Acer platanoides*) are stressed and dying. This urban overlook is almost entirely impervious surface, contributing to increased surface water runoff, formation of gullies, and erosion of the bluff face below.

The stream that flows through the Hidden Falls ravine is very degraded and eroding. Several attempts have been made to stabilize the stream banks by constructing concrete collecting pools and artificial waterfalls. However, the constructed concrete sidewalls to the stream are higher than the ravine floor, which restricts surface water runoff to flow off the ravine side slopes into the stream. This is causing the formation of a second swale alongside the stream channel and increased erosion of the bare ravine floor. The water collected in this eroding swale flows into the concrete-reinforced streambed at a small footbridge downstream.

#### **Summary of Management Issues: Ford Plant Secondary Area**

- **Manage vegetation along turf/woodland edges.**
- **Control erosion below Hidden Falls overlook.**
- **Control erosion at Ford trailer parking area.**
- **Stabilize banks of Hidden Falls stream.**

### **Hidden Falls North Priority Area (48.90 acres):**

The MLCCS identified the two natural community remnants found in this area as mesic oak forest and floodplain forest. The field inventory did not find any additional natural community types or noteworthy features within this management unit. The following text describes the detailed inventory of natural community remnants within the Hidden Falls North Priority Area:

#### ***Natural Community Remnants***

##### **Mesic Oak Forest (4.70 acres)**

###### **North Remnant:**

This mesic oak forest is part of the same low quality remnant that extends up through the Hidden Falls ravine into the Ford Plant Secondary Area. The forest canopy species include red oak (*Quercus rubra*) and bur oak (*Quercus macrocarpa*) with an understory that is dominated by common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*). These two invasive shrub species form dense stands in places and shade out most of the herbaceous understory species. In less shaded areas, shrub species include gray dogwood (*Cornus racemosa*) and downy arrow-wood (*Viburnum rafinesquianum*). Herbaceous species in these areas include Pennsylvania sedge (*Carex pensylvanica*), Sprengell's sedge (*Carex sprengelii*), woodland sedge (*Carex blanda*), motherwort (*Leonurus cardiaca*), white snakeroot (*Eupatorium rugosum*), nightshade (*Solanum dulcamara*), burdock (*Arctium minus*), and garlic mustard (*Alliaria petiolata*). The ravine side slopes are bare and eroding in places, where park visitors have trampled vegetation or buckthorn is dense.

###### **South Remnant:**

This mesic oak forest is of similar quality as the remnant in the Hidden Falls ravine. The canopy is comprised predominantly of red oak (*Quercus rubra*), bur oak (*Quercus macrocarpa*) and hackberry (*Celtis occidentalis*), with occasional basswood (*Tilia americana*). The understory has a well-established stand of common buckthorn (*Rhamnus cathartica*). The herbaceous layer is sparse and includes zigzag goldenrod (*Solidago flexicaulis*), woodland sedge (*Carex blanda*), nightshade (*Solanum dulcamara*), burdock (*Arctium minus*), moonseed (*Menispermum canadense*), motherwort (*Leonurus cardiaca*), and garlic mustard (*Alliaria petiolata*). The slopes appear to have been disturbed and graded in the past for access roads and trails.

##### **Floodplain Forest (5.6 acres):**

Although the floodplain forest remnant in the Hidden Falls North Area is a continuation of the high quality floodplain forest remnant in the Ford Plant Area, this portion of the forest is degraded from lack of flooding and park management practices. Turf areas in the park fragment the floodplain forest. It is in a topographically higher position, and appears to be isolated from frequent (i.e. annual)

inundation. As a result, the understory and herbaceous layer are dominated by noxious weed species. The canopy is comprised of silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), American elm (*Ulmus americana*), box elder (*Acer negundo*), and black willow (*Salix nigra*).

The understory tree species include silver maple, cottonwood, American elm and hackberry (*Celtis occidentalis*), with common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tatarica*) invading. The herbaceous layer includes native species such as wood nettle (*Laportea canadensis*), stinging nettle (*Urtica dioica*), rice cut grass (*Leersia oryzoides*), cutleaf coneflower (*Rudbeckia laciniata*) and spotted touch-me-not (*Impatiens canadensis*). However, numerous invasive weed species such as garlic mustard (*Alliaria petiolata*), burdock (*Arctium minus*), smooth brome (*Bromus inermis*), motherwort (*Leonurus cardiaca*), and creeping Charlie (*Glechoma hederacea*) are common throughout the herbaceous layer. Mown turf areas planted with Kentucky blue grass (*Poa pratensis*) segment the forest into small islands.

### **Summary of Management Issues: Hidden Falls North Priority Area**

- **Control invasive exotic species.**
- **Control erosion on ravine side slopes.**

### **Hidden Falls South Secondary Area (60.0 acres):**

Mesic oak forest and floodplain forest are the two natural community remnants identified by the MLCCS inventory in this area. The field inventory did not find any additional natural community types or noteworthy features within this management unit.

The following text describes the detailed inventory of natural community remnants within the Hidden Falls South Secondary Area:

#### ***Natural Community Remnants***

##### **Floodplain Forest (14.50 acres):**

The floodplain forest remnants are the highest quality natural community remnants within this secondary area. These remnants have closed canopies comprised predominantly of silver maple (*Acer saccharinum*) and large cottonwood (*Populus deltoides*). Common understory trees include American elm (*Ulmus americana*), green ash (*Fraxinus pensylvanicum*), and occasionally box elder (*Acer negundo*). Herbaceous ground layer is comprised by a mix of native species, such as wood nettle (*Laportea canadensis*), stinging nettle (*Urtica dioica*), white snakeroot (*Eupatorium rugosum*), rice cut-grass (*Leersia oryzoides*), spotted touch-me-not (*Impatiens capensis*), and cutleaf coneflower (*Rudbeckia laciniata*). Common buckthorn (*Rhamnus cathartica*) occurs occasionally throughout the understory, along with elderberry (*Sambucus canadensis*). The remnants appear to have been flooded periodically over the past several years, as evident by water marks on vegetation and recently deposited leaf litter and sandy alluvium.

Due to the management of the surrounding parkland as managed turf lawn, edges of these floodplain forest remnants are exposed to light and weed species seed sources, resulting in weed dominated forest edges. Problematic weed species along disturbed edges of these remnants include: purple loosestrife (*Lythrum salicaria*), Kentucky bluegrass (*Poa pratensis*), garlic mustard (*Alliaria petiolaris*), burdock (*Arctium minus*), motherwort (*Leonurus cardiaca*), thistle (*Cirsium arvense*), and creeping Charlie (*Glechoma hederacea*). These non-native species are most abundant along the forest/lawn edge, and also among forest canopy openings within the remnants.

Mesic Oak Forest (7.6 acres):

The mesic oak forest remnant has a closed canopy of bur oak (*Quercus macrocarpa*) and red oak (*Quercus rubra*). Other canopy and sub canopy species within this remnant include green ash and hackberry (*Celtis occidentalis*). This remnant is moderately disturbed, and has been invaded with common buckthorn saplings and seedlings mostly along the upper managed edge. The soil is compacted and eroding with a limited establishment and persistence of a viable herbaceous ground layer.

***Other Ecological Notes:***

No state-listed species were discovered during the inventory of this area. Historic records from the project area suggest that a rare species of sedge, *Carex formosa*, persisted along the bluff toe slopes along this stretch of the Mississippi River. This species and several others were searched for within the highest quality remnant of the Hidden Falls South Secondary Area during the inventory.

A small, linear stormwater swale at the east edge of the southern entrance road contains a large stand of purple loosestrife (*Lythrum salicaria*). This invasive perennial wetland species produces millions of seeds per plant per year, and poses a serious problem in Minnesota wetlands. This stand of purple loosestrife should be managed and/or removed, either with City crews or volunteers.

The hydrology within the floodplain portion appears to be highly altered. There is evidence of a constructed berm (possibly a historic railroad bed) along much of the riverbank that may restrict the floodplain from becoming inundated on an annual basis. The floodplain forest and lowland hardwood forest remnants in this area depend on regular flooding cycles and nutrient deposition to maintain their ecological integrity and structure. It appears that these remnants are flooded only during the wettest spring seasons, such as the spring of 1997.

A high-tension power line right of way, owned and managed by Northern States Power (NSP), runs along the Highway 5 bridge and then north along the floodplain edge of the Mississippi River. This right-of-way consists mostly as old field vegetation, and is periodically cleared of trees.

### **Summary of Management Issues: Hidden Falls South Area**

- **Control invasive exotic species.**
- **Manage vegetation along turf/woodland edges.**
- **Eradicate purple loosestrife near south entrance.**
- **Remove berm along floodplain forest.**

## **A3. Buckthorn Density within each Priority and Secondary Area**

Buckthorn species are the most significant invasive species in the bluffs project area. Figures 5a – 5g shows the densities of buckthorn at various locations within the project area.

The buckthorn density data was gathered as point data using a Corvallis Micro Technology (CMT) handheld global positioning system (GPS) unit, with 1 to 5-meter accuracy. Points were collected on a 25 x 25-meter interval grid across the project area. At each grid point, a 2-meter<sup>2</sup> plot was used to inventory buckthorn infestation levels at that specific point location. Within each plot, the numbers of buckthorn plants present were counted, and tabulated according to four height classifications described below. In all, buckthorn density measurements were obtained at 1662 data points. These point data were then used to develop an estimate of buckthorn infestation throughout the project area. Buckthorn infestation was estimated with a GIS modeling package by interpolating infestation values between each data point. The resulting maps present the estimated buckthorn infestation at four height classes for each management unit, overlaid on 1991 black and white digital orthophoto quads (DOQs).

#### **Legend Definitions:**

**Buckthorn Seedling:** A plant less than 3 feet in height.

**Buckthorn Height Class 2:** A plant greater than 3 feet in height to 1-inch diameter at breast height.

**Buckthorn Height Class 3:** A plant with a 1- to-3 inch diameter at breast height measurement.

Figure 5a – Buckthorn densities

Figure 5b – Buckthorn densities

Figure 5c – Buckthorn densities

Figure 5d – Buckthorn densities

Figure 5e – Buckthorn densities

Figure 5f – Buckthorn densities

Figure 5g – Buckthorn densities

## **A4. Honeysuckle Density within Each Priority and Secondary Area**

Tartarian honeysuckle is a second significant exotic invasive species within the bluffs project area. Figure 6a – 6g indicates the densities of this species at various locations throughout the project area.

The honeysuckle density data was gathered as point data using Corvallis Micro Technology (CMT) handheld global positioning system (GPS) unit, with 1 to 5-meter accuracy. At each grid point, a 2-meter<sup>2</sup> plot was used to inventory honeysuckle infestation levels at that specific point location. Within each plot, the numbers of honeysuckle plants present were counted and tabulated according to three height classifications described below. In all, honeysuckle density measurements were obtained at 1662 data points. These point data were then used to develop an estimate of honeysuckle infestation along the project area. Honeysuckle infestation was estimated with a GIS modeling package by interpolating infestation values between each data point. The resulting maps present the estimated honeysuckle infestation at three height classes for each management unit, overlaid on 1991 black and white digital orthophoto quads (DOQs).

### **Legend Definitions:**

Honeysuckle Seedling: A plant less than 3 feet in height.

Honeysuckle Height Class 2: A plant 3 to 6 feet in height.

Honeysuckle Height Class 3: A plant greater than 6 feet in height.

## **A5. Major Erosion Areas**

Erosion areas were inventoried for the entire project area. Problem areas are indicated in Figure 7. Erosion is a natural process associated with bluff ecology. This inventory focused primarily on identifying areas where erosion is accelerated due to park use (trails, pedestrian access), land use practices (tree cutting and maintenance, lawn mowing) and unnatural hydrology (stormwater flow, increased surface water runoff due to compaction and lack of vegetation).

## **A6. Socio-Cultural Features (Figure 4)**

The socio-cultural features were gathered as point and line data using a Corvallis Micro Technology (CMT) handheld global positioning system (GPS) unit, with one to five-meter accuracy. These data were mapped within a geographic information system and were overlaid on 1991 black and white digital orthophoto quads (DOQ) available from the Metropolitan Council. Socio-cultural data were collected in October 2000.

**Viewpoints:** A specific location that lends a panoramic view of the river, the river valley, or one of its geologic or cultural points of interest. Most viewpoints are associated with a park bench at the Mississippi River Bluffs.

Managed – Less than 50% of the view obstructed by plant material greater than six feet in height.

Non-Managed – More than 50% of the view obstructed by plant material greater than six feet in height.

**Overlooks:** An area for bluff visitors to gather and share a panoramic view of the river, the river valley, or one of its geologic or cultural points of interest. Most overlooks are associated with a parking area at the Mississippi River Bluffs.

**Stairs:** stepped, man-made structures allowing easy access to points of interest. Stairs may be constructed of metal, wood, or stone. This designation also includes pedestrian bridges.

**Benches:** A permanent man-made structure providing a seated, resting point for visitors. Also includes picnic tables.

**Trail Entrances:** Access point to dirt footpaths originating at the bluff's edge.

*Primary* – Access point to dirt footpaths originating at the bluff's edge, with an initial opening greater than one meter in width.

*Secondary* – Access point to dirt footpaths originating at the bluff's edge, with an initial opening less than one meter in width.

**Unpaved Trail:** An undesignated dirt footpath.

**Paved Trail:** A designated paved pedestrian and/or biking path (such as the trail along the bluff tops along Mississippi Boulevard).

Figure 6a – Honeysuckle densities

Figure 6b – Honeysuckle densities

Figure 6c – Honeysuckle densities

Figure 6d – Honeysuckle densities

Figure 6e – Honeysuckle densities

Figure 6f – Honeysuckle densities

Figure 6g – Honeysuckle densities

Figure 7 – Major erosion areas

Figure 8 – Socio Cultural Features

Figure 9a

Figure 9b

Figure 10a

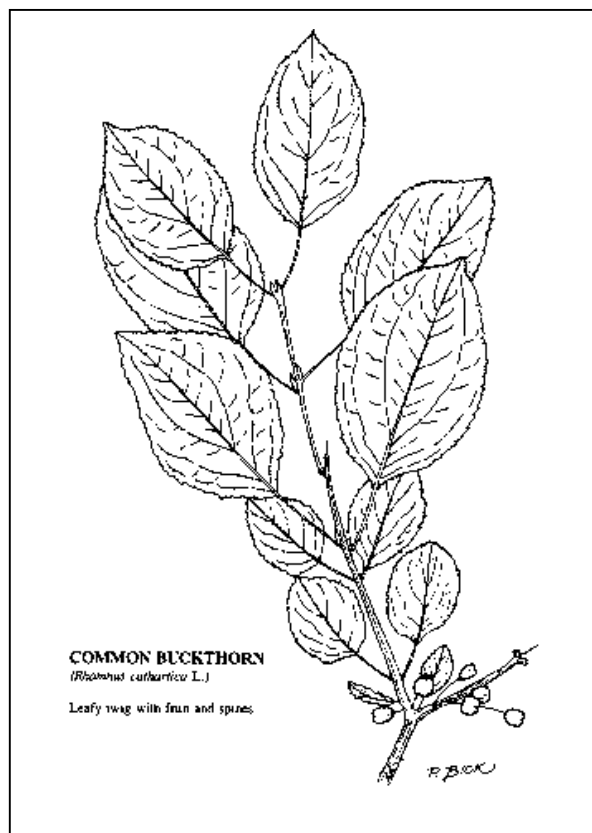
Figure 10b

Figure 10c

## Appendix B. Fact Sheets on invasive, exotic species

*Common Buckthorn*

*Rhamnus cathartica*



### Effects of Invasion:

Common buckthorn is a problem species in the understory of maple-basswood and oak woodlands, oak savannas and prairies. Common buckthorn is characterized by long distance dispersal ability, prolific reproduction by seed and wide habitat tolerance. The fruit causes a severe laxative effect, readily distributing its seeds when eaten by birds. Once established, common buckthorn has the potential to spread very aggressively in large numbers because they thrive in habitats ranging from full sun to shaded understory. Common buckthorns leaf out very early and retain their leaves late in the growing season, thereby shading out herbaceous and low shrub communities and preventing the establishment of tree seedlings.

**Size:** 18-25 feet in height with a comparable spread.

**Habit:** Large shrub or low-branched tree with a rounded, bushy crown of crooked, stoutish stems.

**Leaves:** Dull green, ovate-elliptic shaped, smooth on both surfaces with minute teeth on the margins, and pointed tips.

**Stem:** Slender, somewhat grayish, often having thorn-like spurs.

**Bark:** Generally gray to brown with prominent, often elongate, light-colored or silvery lenticels.

**Fruit:** Female plants have ¼ inch diameter clusters of black, rounded fruit.

**Origin:** Europe and Asia.

**Range:** Nova Scotia to Saskatchewan, south to Missouri, and east to New England.

**Mechanical Control:**

- Prescribed burns in early spring and fall may kill seedlings, larger stems, and top-killed mature buckthorns. Burning is preferable for fire-adapted communities, but should not be used if it adversely affects the community. Burning annually or biannually to control buckthorn may need to be continued for several years depending on the extent of establishment and the seed bank, which generally lasts three to five years. It is generally difficult to burn in dense buckthorn stands, as the understory is typically well shaded, allowing little fuel build-up.
- Hand pull or weed wrench seedlings.
- Weed wrench saplings up 1-inch in diameter at breast height (measurement).
- Trees with 1-3 inches in diameter at breast height (measurement) may be weed wrenched if growing in sandy soils, otherwise, cut and apply herbicide to the stump.

**Chemical Control:**

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

**Cut and Spray:**

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

Basal Bark Treatment:

- A band of 6% Triclopyr with oil in diesel fuel or diluent oil on the lower 10 inches of bark including the root collar.

**Source:** Wisconsin Department of Natural Resources 1997.  
Minnesota Department of Natural Resources 1995.

**Honeysuckle**      *Lonicera tartarica*



**Effects of Invasion:**

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

**Size:** 3-10 feet in height with a 10-foot spread.

**Habit:** Upright, strongly multi-stemmed with the upper branches arching and the overall effect one of a dense, twiggy mass.

**Leaves:** Smooth, hairless, opposite, simple, smooth beneath, ovate, bluish-green, leaves. Begin leaf development early in the spring before native species.

**Stem:** Green at first, finally brownish.

**Bark:** Older stems are shaggy.

**Fruit:** Red, ¼ inch diameter berry that colors in late June into July and August.

**Flower:** Fragrant, tubular pink to crimson flowers arranged in pairs.

**Origin:** Central Asia to Southern Russia.

**Range:** New England south to North Carolina and west to Iowa.

**Mechanical Control:**

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

**Chemical Control:**

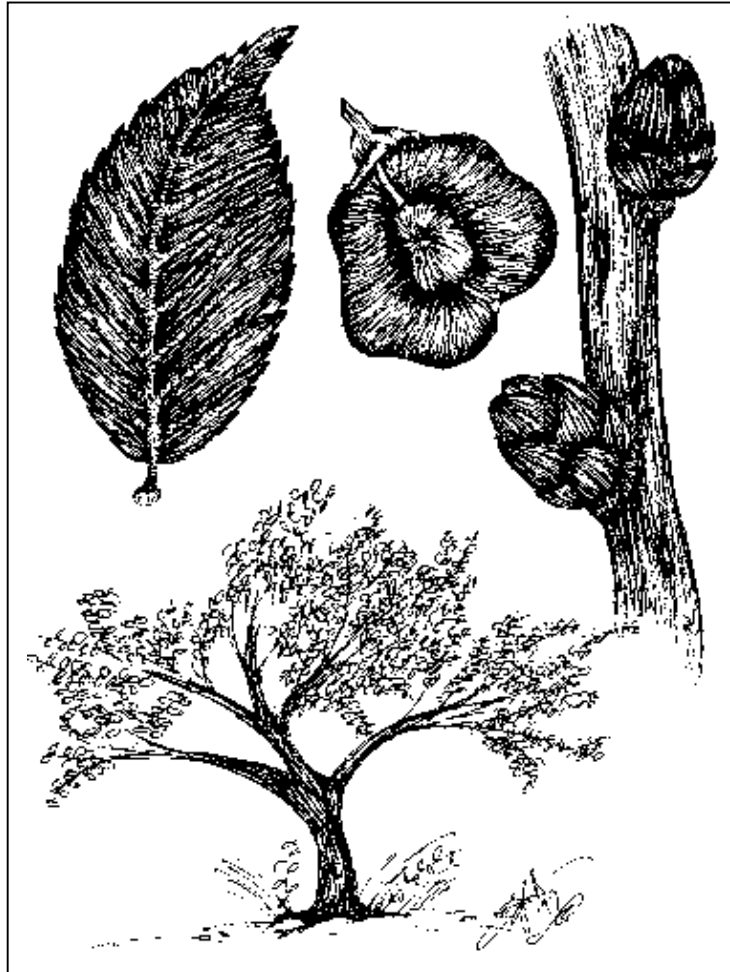
- Cut and apply herbicide to any honeysuckle regardless of size if soil conditions are not appropriate for mechanical control.
- A herbicide formulated for use over water should be used in high quality natural areas and in aquatic environments where surface water is present.
- Control methods must be repeated for at least three to five years in order to stop new plants emerging from the seed bank. Underplanting disturbed areas with tolerant native species may hinder reinvasion of Tartarian honeysuckle.

**Cut and Spray:**

- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% Glyphosate solution sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. The effectiveness of chemical treatment during the growing season is generally lower and may have to be repeated on resprouts.
- Winter (from first hard freeze to first budding in May): 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or diluent oil sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. This is the most effective time of the year for chemical treatment.
- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% glyphosate solution formulated for use over water should be used in high quality natural areas and in aquatic environments where surface water is present.

**Source:** Wisconsin Department of Natural Resources  
Minnesota Department of Natural Resources 1995.

Siberian Elm      *Ulmus pumila*



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

**Size:** 50-70 feet in height with a 40-50 foot spread.

**Habit:** Open, round crown of slender, spreading branches.

**Leaves:** Small, elliptical, smooth singly toothed leaves that reach lengths of approximately 0.8-2.6 inches. They are tapering or rounded at their asymmetrical base.

**Stem:** Slender, brittle, very light gray or gray-green, usually smooth, can be slightly hairy, roughened by lenticellar projections.

**Bark:** Gray or brown, with shallow furrows at maturity.

**Fruit:** Single winged circular or ovate in shaper with smooth surface.

**Flower:** Greenish, lack petals, and occur in small drooping clusters of 2-5 blossoms.

**Origin:** Eastern Siberia, northern China, Manchuria and Korea.

**Range:** Minnesota south to Arkansas and west to Utah.

**Mechanical Control:**

- Girdling: Late Spring to Mid Summer: girdle trees by removing a band of bark around the tree trunk, just within the bark layer (cambium). Girdling to deeply may lead to resprouting. Girdled trees die slowly over a one to two year period.
- Hand pull or weed wrench seedlings.
- Prescribed burns on a regular bases in fire-adapted communities. Saplings older than a few years may not be killed by fire, and instead will require another control method.

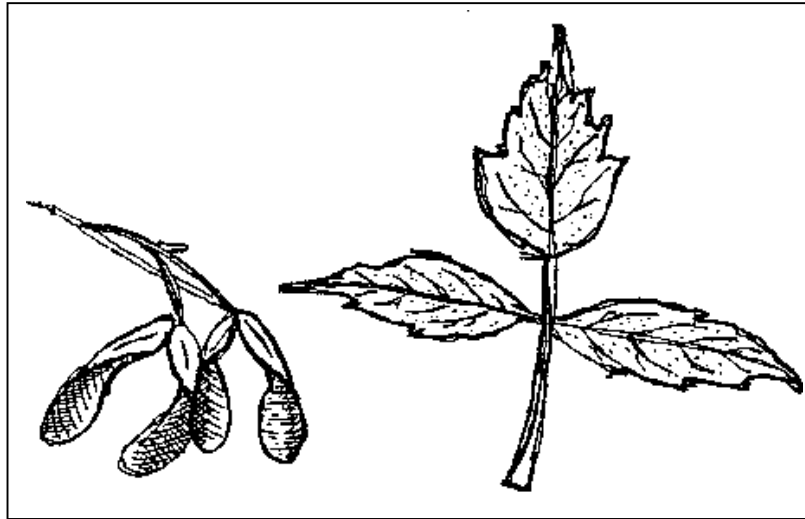
**Chemical Control:**

## Cut and Spray

- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% Glyphosate solution sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. The effectiveness of chemical treatment during the growing season is generally lower and may have to be repeated on resprouts.
- Winter (from first hard freeze to first budding in May): 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or diluent oil sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. This is the most effective time of the year for chemical treatment.
- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% glyphosate solution formulated for use over water should be used in high quality natural areas and in aquatic environments where surface water is present.

**Source:** Wisconsin Department of Natural Resources  
Minnesota Department of Natural Resources 1995.

**Boxelder**     *Acer negundo*



**Effects of Invasion:** Boxelder is an opportunistic species native to the United States. Extremely prolific, it will inhabit many environments disturbed by humans. Boxelder produce seeds during summer and fall and the wind disperses the fruits to suitable habitats for germination. Reproduction can also take place vegetatively through suckers, sprouts, and root shoots. Boxelders are aggressively opportunistic and tend to shade out smaller, herbaceous flora.

**Size:** 30-50 feet in height can reach 70 feet with spread equal to or greater than the height.

**Habit:** Usually rounded to broad-rounded in outline, branches develop irregularly to support the uneven crown.

**Leaves:** Pinnately compound and have 3-5 leaflets arranged oppositely on the stem. Leaflets can be lanceolate to oblong, with margins that may be separated into several shallow lobes.

**Stem:** Green to reddish brown, often covered with a waxy whitish bloom that can be rubbed off.

**Bark:** Gray-brown, slightly ridged and furrowed.

**Fruit:** Double winged produced by females.

**Flower:** Male plants bear stamens in umbel-like arrangements, while the female plant produce apetalous racemes.

**Origin:** United States and Southern Canada.

**Mechanical Control:**

- Large-diameter trees can be cut with a chainsaw. Resprouts must be recut, or herbicides may be applied to the cut stump.

**Chemical Control:**

Cut and Spray

- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% Glyphosate solution sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. The effectiveness of chemical treatment during the growing season is generally lower and may have to be repeated on resprouts.

- Winter (from first hard freeze to first budding in May): 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or diluent oil sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. This is the most effective time of the year for chemical treatment.
- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% glyphosate solution formulated for use over water should be used in high quality natural areas and in aquatic environments where surface water is present.

**Source:** Wisconsin Department of Natural Resources  
Minnesota Department of Natural Resources 1995.

**Cottonwood      *Populus deltoides***



**Effects of Invasion:**

The female flowers of cottonwood are pollinated in the springtime, giving rise to many-seeded capsules that are dispersed by wind and water. Reproduction can also take place vegetatively through suckers, sprouts, and root shoots. Saplings flourish in damp, well-lit areas. Once in sapling stage cottonwoods are difficult to eradicate.

**Size:** 75 to 100 feet in height spreading 50 to 75 feet.

**Habit:** Pyramidal in youth but developing a broad vase-shaped habit in old age with the branching structure being somewhat open, irregular and ragged; often with massive, spreading branches. Multi-stemmed cottonwoods may reach diameters of over 10 feet.

**Leaves:** Simple and alternately arranged on the stems. Broad, flat bases that taper to a point near the tips. Leaf margins are deeply serrate and often curve inward towards the centermost veins of their blades.

**Stem:** Stout, yellowish to greenish yellow to brown, round or marked especially on vigorous trees with more or less prominent wings running down from the two sides and bases of the leaf-scars.

**Bark:** Nearly black, deeply furrowed, and decorated with resinous, many-scaled leaf buds in winter.

**Fruit:** 2 to 4 valved capsule, ¼ to 1/3 inch long, the seeds are tufted and look like fuzzy cottonballs floating through the air.

**Flower:** Pendulous catkins appearing before the leaves. Males have red anthers on their stamens and females a single pistil.

**Origin:** Quebec to North Dakota, Kansas, Texas, Florida.

**Mechanical Control:**

- Girdling: Late Spring to Mid Summer: girdle trees by removing a band of bark around the tree trunk, just within the bark layer (cambium). Girdling to deeply may lead to resprouting. Girdled trees die slowly over a one to two year period.
- Hand pull or weed wrench seedlings.

**Chemical Control:**

## Cut and Spray

- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% Glyphosate solution sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. The effectiveness of chemical treatment during the growing season is generally lower and may have to be repeated on resprouts.
- Winter (from first hard freeze to first budding in May): 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or diluent oil sprayed on cut stumps. Herbicide should be sprayed immediately after cutting to be effective. This is the most effective time of the year for chemical treatment.
- May to October (Between first budding in May, through summer, to hard freeze in fall): 25% glyphosate solution formulated for use over water should be used in high quality natural areas and in aquatic environments where surface water is present.

**Source:** Wisconsin Department of Natural Resources  
Minnesota Department of Natural Resources 1995.