Desnoyer Seep
Native Plant Community Inventory
and Management Recommendations

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Prepared for:
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Department of Parks and Recreation

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Overall Context:

Desnoyer Seep is a small seepage area (approximately 0.28 acres) on the east side of the Mississippi River Gorge in St. Paul. It occurs between River Road and the Mississippi River near the intersection of Eustis St. and River Road (Figure 1). A large (10+ foot diameter) storm sewer outlet occurs along the Mississippi River shoreline just upstream of the wetland. A large sandbar created from water flowing out of the storm sewer occurs just off shore and slightly downstream from the storm sewer outlet.

Cliffs of Platteville limestone occur above the wetland along the upper edge of the bluffs. Groundwater is emerging approximately 20 to 30 feet below the cliffs and appears to be flowing out of the base of the Platteville limestone near its contact with the underlying Glenwood shale. Below this "upper terrace," the Seep slopes down the side of the valley to where it flows into the Mississippi River. Soils in the wettest part of the Seep consist of a shallow layer of muck over clayey soils. Limestone fragments are scattered down the bluff slopes to the river bottoms. St. Peter Sandstone, the layer below the Platteville and Glenwood layers, is not exposed in this part of the valley.

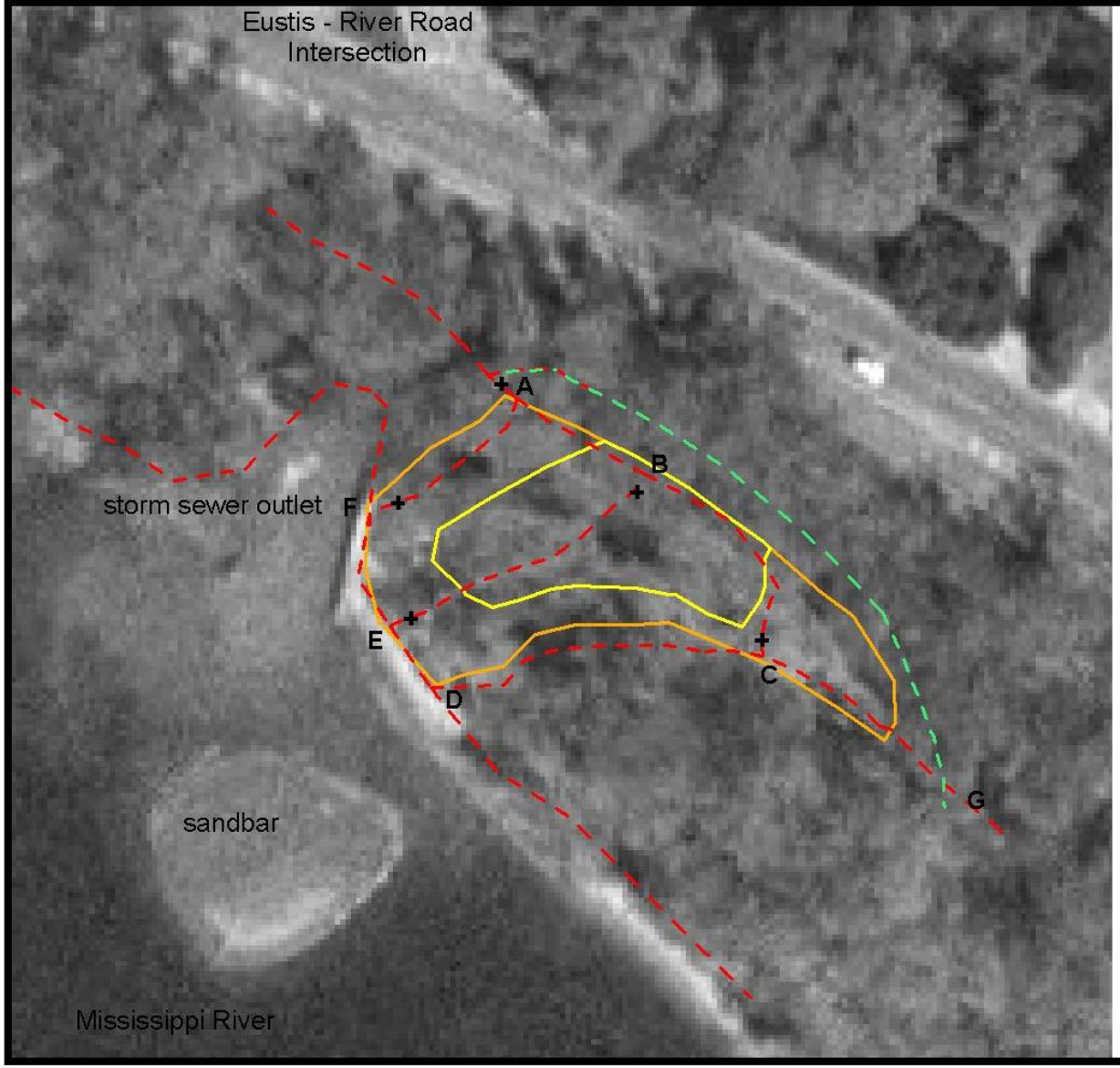
Currently, groundwater flows abundantly into the wetland throughout the year. If this groundwater flow should be decreased in the future, the wetland will be taken over by shrubs and trees at the expense of native wetland grasses and sedges.

The vegetation of Desnoyer seep was surveyed on July 7th and August 12th, 2004. The wetland has two distinct zones. These are a wet inner zone of saturated mucky soils with actively flowing surface water, and an outer zone of wet mineral soils lacking flowing surface water. For a list of the plant species recorded in the wetland, see Table 3 on page 13.

Inner zone vegetation:

The wettest zone has flowing water on the ground surface. Red oxidized iron deposits are very common in shallow groundwater pools. The primary dominant plants within the wettest part of the seep are the invasive species narrow leaf cattail (*Typha angustifolia*) and purple loosestrife (*Lythrum salicaria*). Black bulrush (*Scirpus atrovirens*), a native sedge, is also abundant throughout this zone. Common reed (*Phragmites australis*) is another invasive species that co-dominates in a lower part of the seep. A couple of small, green ash trees are present on the lower slopes of the wetland. Various shrubs are frequent: mostly heart-leaved willow (*Salix eriocephala*), red osier dogwood (*Cornus sericea*), and high bush cranberry (*Viburnum trilobum*). Little native vegetation is visible within the cattail/loosestrife thicket. Bottlebrush sedge (*Carex hystericina*), a low sedge with moderate-width leaves, is scattered throughout the cattail-dominated areas. Other sedges and grasses that are present are mostly relegated to the edges of dense cattails; these are primarily soft stem bulrush (*Scirpus validus*), fowl manna grass (*Glyceria striata*), fowl meadow grass (*Poa palustris*), and two short species of rush *Juncus nodosus* and *Juncus torreyi*. A fairly low diversity of native forbs is present and these are also located mostly outside dense cattail thickets. These forbs include swamp milkweed (*Asclepias incarnata*), American water hore-hound (*Lycopus americanus*), eastern willow herb (*Epilobium coloratum*), and Pennsylvania saxifrage (*Saxifraga pennsylvanica*).

Figure 1: Desnoyer Seep Wetland and Trails



Outer wetland zone (less wet)

Inner wetland zone (wettest)

Existing trails

A Trail labels

Proposed trail reroute

Recommended barriers

0 0.01 Miles

Outer zone vegetation:

The outer zone consists of wet mineral soils without flowing surface water on the margins of the wetter, inner zone. The largest area of these wet mineral soils is in the extended tip of the wetland on the east end of the Seep. The vegetation in this zone contains species of wet prairies co-dominated by the same shrub species present in the inner zone. Mixed in with the shrubs are several grasses and sedges: woolly sedge (*Carex lanuginosa* (also classified as *C. pellita*)), switchgrass (*Panicum virgatum*), muhly grass (*Muhlenbergia racemosa*), and several short species of rush (*Juncus dudleyi, J. nodosus, J. torreyi)*. The woolly sedge is concentrated in approximately a 2 square meter size area at mid slope on the west side of the seep. Woolly sedge and switchgrass are commonly dominant species in wet prairies. This zone also contains a low diversity of native forbs, including New England aster (*Aster novae-angliae*), swamp milkweed, grass-leaved goldenrod (*Euthamia graminifolia*), and Canada goldenrod (*Solidago canadensis*). Several exotic species have infested this zone: redtop (*Agrostis stolonifera*) and Kentucky bluegrass (*Poa pratensis*) are present throughout; other scattered exotics include reed canary grass (*Phalaris arundinacea*), Canada thistle (*Cirsium arvense*), white sweet clover (*Melilotus alba*), sow thistle (*Sonchus uliginosus*), common buckthorn (*Rhamnus cathartica*), and glossy buckthorn (*Rhamnus frangula*).

Vegetation on drier ground outside the Seep:

Oak woodland in fair condition covers drier ground outside the Seep. These woods contain a hodge-podge of different tree species including boxelders, bur oak, basswood, red oak, silver maple, and cottonwoods. A few native woodland wildflowers are present, including sarsaparilla (*Aralia nudicaulis*), Virginia waterleaf (*Hydrophyllum virginianum*), bloodroot (*Sanguinaria canadensis*), and wood nettles (*Laportea canadensis*). Numerous invasive species typical of weedy, open gaps are also present including common buckthorn, burdock (*Arctium minus*), eastern red cedar (*Juniperus virginiana*), staghorn sumac (*Rhus typhina*), orchard grass (*Dactylus glomerata*), and creeping Charlie (*Glechoma hederacea*).

Management recommendations:

Several invasive species should be controlled or removed from the wetland. The invasives with the greatest amount of cover are narrow leaf cattail, purple loosestrife and common reed. Several native wetland grasses and sedges exist in the site that should expand their coverage once the invasives are reduced or removed, including: black bulrush, bottlebrush sedge, fowl meadow grass, and fowl manna grass in the inner zone; and switchgrass and woolly sedge in the outer zone. Other native grass and sedge species may still be present in the seed bank and may germinate and re-establish themselves once the invasives are removed and the wetland is exposed to sunlight.

Because this is a very small site, and because other native plant species are present within the areas dominated by invasives, we recommend starting invasive species removal using primarily mechanical control methods. These methods have to be repeated annually for several years to succeed. The invasives will have seeds in the seed bank that

will eventually be exhausted as they are removed and prevented from setting seed. In the case of reed canary grass and common reed, mechanical cutting is not sufficient to set back the plants and herbicide should be applied.

Cattails, reed canary grass, and common reed all thrive in areas of excessive nutrients. Lawn fertilizer is likely reaching the Seep from surrounding neighborhoods. To assess the extent to which nutrient levels in the Seep are a problem, nitrogen and phosphorus concentrations in the Seep's groundwater should be measured and evaluated. A watershed-wide approach to reducing nutrients will help in the fight against invasives.

The wetland should be cleared of enough invasives and other trees and shrubs so that it is exposed to sunlight. Native grasses and sedges already growing in the wetland may expand and re-establish their dominance in the wetland. Seeds of native grasses and sedges already present in the soil may germinate once the dense cover of invasives is removed. Seed from native plants already growing in the Seep can be collected as they mature in late summer and spread onto areas of bare soils.

Table 1: Summary of recommended process for management

Timing	**Activity**
Year 1, May - June	Invasive species control. Cut cattails at bases when they are flowering; repeat cattail cutting 1 month later. Pull/dig up whole purple loosestrife and Canada thistle plants. Cut reed canary in June. Cut and stump treat common and glossy buckthorn. Cut eastern red cedar trees and use trunks to block trails.
Year 1	Block access to trails that cut across the wetland where indicated in Fig. 1; clear fallen trees and brush from trail reroute area; establish an alternative trail route above the wetland
Year 1 mid to late summer	Collect ripe seed from native grasses and sedges in the wet zone on site and spread them into bare spots formerly occupied by cattails. Sedge seed tends to have low viability, so large amounts of seed may result in few plants.
Late July-Aug.	Cut common reed when it starts flowering and fill cut "stumps" with Rodeo
Year 1, after 1st frost	Apply herbicide to reed canary grass plants that were cut in June.
Year 2, May - June	Invasive species control. Cut cattails at bases when they are flowering; repeat cattail cutting 1 month later. Pull up whole purple loosestrife and Canada thistle plants. Cut reed canary in June. Cut and stump treat common and glossy buckthorn if necessary.
Year 2	Monitor for regrowth of native grasses and sedges – are they reestablishing dominant cover in areas formerly dominated by cattails/purple loosestrife/common reed?
Year 2, mid to late summer	Collect ripe seed from native grasses and sedges in the wet zone on site and spread them into bare spots formerly occupied by cattails. Sedge seed tends to have low viability, so large amounts of seed may result in few plants.
Yr. 2, late Jul.-Aug.	If plants still remain, cut common reed when it flowers and fill cut "stumps" with Rodeo.
Year 2, late Sept. or Oct.	Apply herbicide to reed canary grass plants if they were cut in June of year 2
Year 3, growing season	Continue invasive species control methods throughout the season as done in previous two years. Evaluate effectiveness of invasive species control: if necessary, implement herbicide treatments (Rodeo) for species previously controlled only mechanically (see notes below)
Year 3, June	If native wetland plant species have not re-established wetland cover after invasive species control, plant transplants or plugs of wetland plants (listed in table 2) into the wetland
Year 4	Continue invasive species control where necessary

Invasive species to target for immediate removal, with notes on removal strategies:

Narrow leaf cattail (*Typha angustifolia*): Dominant throughout the wettest part of the wetland. Cut whole plants off at the base in late spring after seed heads are formed but not yet mature. Cut same plants again 1 month later. Repeat for several years. If mechanical control is not successful, apply Rodeo to plants in the fall (September) as they are sending nutrients down to the roots. Application should be very careful to avoid herbicide contact on other plants. Apply herbicide to the entire above-ground plant parts using glove or wick application. New plants are likely to germinate from seed in the soil.

Purple loosestrife (*Lythrum salicaria*): A common species in the wettest part of the wetland. Remove plants before the onset of seeds in late August. Hand pull young plants; remove large plants with a shovel if necessary to get roots. If mechanical control is unsuccessful, apply Rodeo to all of the foliage of individual plants in late July or August. Biological control organisms can be released, but mechanical/chemical control will result in more complete eradication of the plant from the site.

Common reed (*Phragmites australis*): This is a very tough, aggressive species, common within a small portion of the wetland, that requires herbicide treatment in addition to cutting. A successful approach described by Martin (2001) is as follows: cut common reed when it begins to flower (late July) then fill the hollow reed "stumps" with Rodeo herbicide. Repeat for several years if necessary. Avoid excessive cutting of this species at other times of year, which might cause it to increase its density. Remove cut shoots to prevent them from sprouting and forming stolons.

Reed canary grass (*Phalaris arundinacea*): Infrequent on margins of the Seep and along trails. Presently, this species is not a major dominant in the wetland. Cut as plants begin to flower in June. In late September or October, after first frost, apply herbicide (Roundup on drier ground; Rodeo within wetland) to plants that were cut in June. Chemical treatment should be with a glove or wick applicator so as to avoid chemicals from hitting other plants. Successful suppression of reed canary grass has been achieved by re-establishing a canopy of native grasses and sedges over areas formerly occupied by reed canary plants.

Canada thistle (*Cirsium arvense*): Occasional. Cut when the plants are in early flower bud stage. Pull or cut at least 3 times during the growing season, e.g. June, August, September. If mechanical control is unsuccessful, apply Rodeo in wetland (use Transline on dry ground) via glove application to whole plants in spring when they are 6-10 inches.

Common buckthorn (*Rhamnus cathartica*): Scattered throughout the wetland. Pull small plants; cut large plants and treat stumps with herbicide (use Garlon on dry ground, or in wetlands a Garlon alternate approved for wetlands).

Glossy buckthorn (*Rhamnus frangula*): Scattered in the wetland. Pull small plants; cut large plants and treat stumps with herbicide (use Garlon on dry ground, or in wetlands a Garlon alternate approved for wetlands).

Eastern red cedar (*Juniperus virginiana*): Approximately ten large and small trees have established within the wetland and on its perimeter. These are shading the wetland and should be cut and removed. Cut trunks can be used in trail barriers.

Other invasive species within and outside the seep to remove as time and resources permit:

White sweet clover (*Melilotus alba*): uncommon on dry ground in open areas. Remove by hand pulling.

Sow thistle (*Sonchus uliginosus*): occasional in the wet ground; remove by pulling

Burdock (*Arctium minus*): infrequent; in open areas on dry land.

Boxelder (*Acer negundo*): remove trees that are shading the wetland; remove any female trees in the area. Removal is by cutting and treating stumps with Garlon. Treatment is unsuccessful in spring during sap flow.

Orchard grass (*Dactylus glomerata*): a few plants occur along the trail on dry land in open areas. Remove by pulling.

Staghorn sumac (*Rhus typhina*): a few plants are present on the margins of the wetland; these could expand clonally and crowd out native plants. Remove by cutting twice a year in July and August over several years. If mechanical control has been unsuccessful after 3 years, apply Garlon to cut stumps.

Red top (*Agrostis stolonifera*): common on wet ground. These plants should be crowded out by taller native sedges and grasses.

Kentucky bluegrass (*Poa pratensis*): common on dry ground.

Transplanting native wetland plants into the Seep

If natives present as plants or in the seed bank do not naturally begin to re-establish continuous vegetative cover in the Seep following two years of invasive species control, some native wetland plants from nearby wetlands should be added to bare areas in the Seep as transplants or plugs. Potential species to use for this, in addition to natives already present in the wetland, are listed in Table 2. This list includes some forbs that are abundant in seepage wetlands which, if planted, could enhance the diversity of the Seep. The main species for planting to replace cattails should be lake sedge (*Carex lacustris*), a species that was not seen in the Seep in this inventory. Plants of this species could be brought from nearby wetlands, such as in Crosby Park where it occurs in marshes on the north side of Crosby Lake. A few plants could be dug up and broken off of large clones in the spring (early June) and transplanted into the wettest parts of the Seep. Once planted into the wetland, this species should spread by rhizomes and colonize other parts

of the Seep. Bluejoint is a grass that also can be planted to occupy bare space within the Seep. Rhizomes for this species can also be obtained from same part of Crosby Park marshes as lake sedge. Alternatively, plugs of these species could be obtained from a local nursery, such as one maintained by Ramsey - Washington Watershed District.

Table 2: Potential additional wetland species (not already present in the seep) to plant as necessary into areas devoid of native species cover after invasives removal (list was culled from Southern Seepage Wetland list of Dunevitz and Lane 2004):

Common name	Scientific name	Lifeform	Comment
lake sedge	*Carex lacustris*	graminoid	potential dominant in wettest parts – plant in unshaded areas formerly occupied by cattails – this species is the best native species to replace cattails
bluejoint	*Calamagrostis canadensis*	graminoid	potential vegetative dominant; wet zone
bristly sedge	*Carex stipata*	graminoid	not a vegetative dominant; wet zone
tussock sedge	*Carex stricta*	graminoid	potential vegetative dominant on edges of the wettest areas
great water dock	*Rumex orbiculatus*	forb	wet zone
boneset	*Eupatorium perfoliatum*	forb	wet and outer zones
joe pye weed	*Eupatorium maculatum*	forb	wet and outer zones
marsh marigold	*Caltha palustris*	forb	consider planting into areas of surface water flow in wet zone
fringed loosestrife	*Lysimachia ciliata*	forb	wet zone
skunk cabbage	*Symplocarpus foetidus*	forb	consider planting in wet zone into areas of surface water flow with partial shade
flat topped aster	*Aster pubientor (umbellatus)*	forb	wet zone
marsh bellflower	*Campanula aparinoides*	forb	wet zone
tufted loosestrife	*Lysimachia thyrsiflora*	forb	wet zone

Existing Trails:

Trail locations were recorded in the field using a GPS unit and then drawn in Arcview GIS. These trails are labeled in Figure 1 and described below:

Trail ABC: This trail is the continuation of the trail that runs parallel to the river along the upper slope of the bluffs. It runs within the wetland along its upslope edge. The trail is very wet and muddy. Tracks indicate mountain bikes have driven along it. We recommend closing this trail by piling logs and brush across access points to the trail. We propose the trail be rerouted 20 to 25 feet upslope from the wetland along the base of the limestone cliffs (see Figure 1, and discussion on page 10).

Trail AF: A small, steep trail running down the bluff to the side of the storm sewer outlet along the Mississippi River. This trail runs along the west edge of the wetland. We recommend that access to this trail be blocked at both the top and the bottom of the trail, as indicated in Figure 1. Traffic moving downslope should be rerouted to route GCD.

Trail BE: A small, steep trail running down the bluff through the middle of the wetland. Much water runs along the surface of this route. We recommend closing access to this trail at both the top and the bottom of the trail, as indicated in Figure 1. Traffic moving down the slope should be rerouted to trail DCG.

Trail FED: This route is part of the well used trail that runs along the river along the bottom of the bluffs. We recommend it be allowed to remain, but access to trails AF and BE should be blocked with logs or barriers.

Trail DCG: This is a well established trail that runs down the bluff along the downstream side of the wetland. The steepest portions of the trail near point D are prone to erosion and should be converted to stairs. A heavy gauge, 9 to 12 inch diameter pipe runs across the trail midway up the steep part of the bluff slope. This pipe outlets just downslope of the trail. The upslope end of the pipe appears to be buried in the wetland. There is no evidence of recent water flow from this pipe: none of the soil below the pipe opening has been washed out from water flowing out of the pipe. This pipe could be left as it is.

Proposed Trail Reroute:

We propose that the main trail running across the seep (trail ABC in Figure 1) be blocked and an alternative route be created that runs 20 to 25 feet further upslope, or about 10 to 15 feet from the base of the limestone cliffs. This area is on firm, dry, nearly level ground occupied by cottonwoods and boxelder trees. Most of the groundwater seepage that is entering the wetland emerges downslope of this area. Currently, traffic is blocked from moving through this area by two trees that have toppled from the top of the limestone cliff and by brush that was cut upslope of the cliff and dumped over the cliff. These trees and brush should moved out of the way and used to block access to trail ABC where indicated in Figure 1.

Trail design along the reroute should allow passage of surface water moving down the slope. One potential design solution would be to level the surface of the new trail location and cover it with flagstones (see diagrams in Figures 2 and 3). Flat pieces of Platteville limestone are abundant in this area and could be used as flagstones. Allow some spacing between flagstones so water can flow between the stones. It appears that surface water flow at this location is limited enough so that this kind of trail (as opposed to an elevated boardwalk) may be sufficient.

Figure 2: Illustration of top view of a flagstone path showing spaces for surface water flow (drawing by Ryan Holdorf for Great River Greening in Shaw et al. 2004)

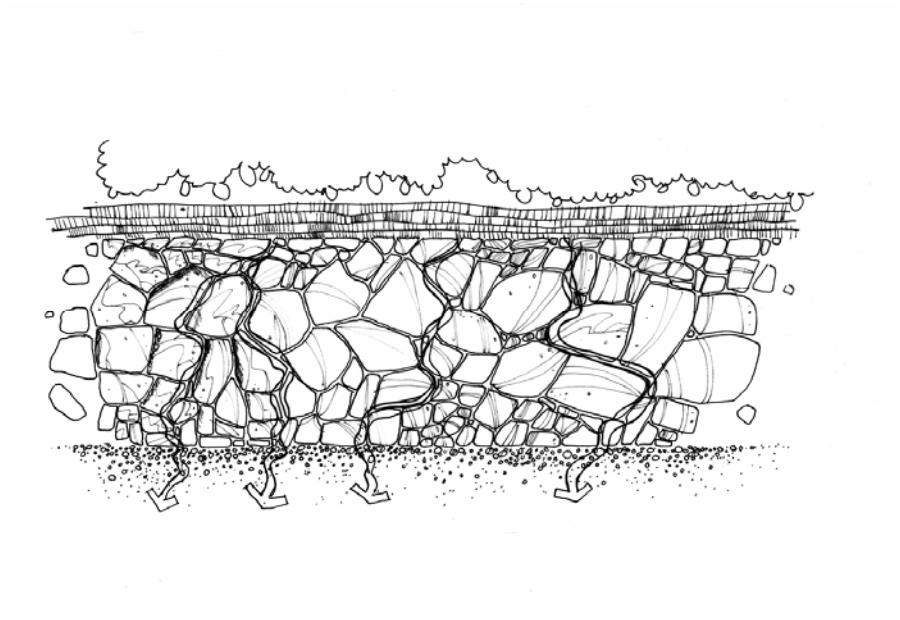


Figure 3: Cross section view of flagstone path (drawing by Ryan Holdorf for Great River Greening in Shaw et al. 2004)

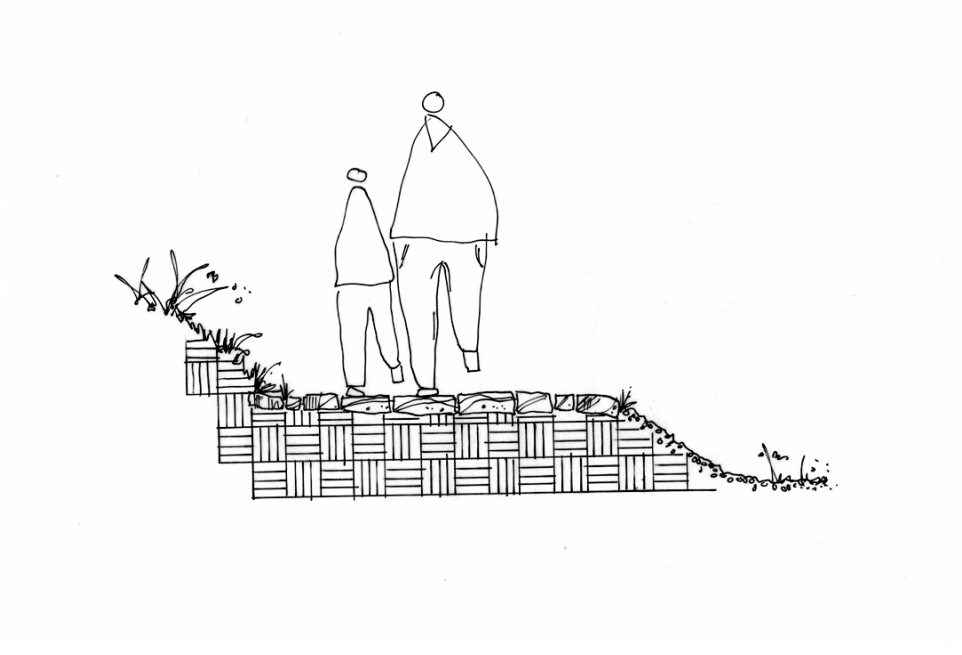


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Table 3: Desnoyer Seep Plant List: plants present in inner and outer wetland zones in 2004

scientific name	common name	zone: i = inner o = outer	exotics	lifeform	recommendation
Agrostis stolonifera	redtop	o	e	graminoid	
Carex hystericina	bottlebrush sedge	i		graminoid	promote
Carex lanuginosa	woolly sedge	o		graminoid	promote
Glyceria striata	fowl manna grass	i		graminoid	promote
Juncus dudleyi	Dudley's rush	o		graminoid	promote
Juncus nodosus	rush	i,o		graminoid	promote
Juncus torreyi	Torrey's rush	i,o		graminoid	promote
Muhlenbergia racemosa	muhly	o		graminoid	promote
Panicum virgatum	switchgrass	o		graminoid	promote
Phalaris arundinacea	reed canary grass	o	e	graminoid	remove immediately
Phragmites australis	common reed	i	e	graminoid	remove immediately
Poa palustris	fowl meadow grass	i		graminoid	promote
Poa pratensis	Kentucky bluegrass	o	e	graminoid	
Scirpus atrovirens	black bulrush	i		graminoid	promote
Scirpus validus	softstem bulrush	i		graminoid	promote
Typha angustifolia	narrow-leaved cattail	i	e	graminoid	remove immediately
Ambrosia artemesiifolia	common ragweed	o	e	forb	
Apocynum androsaemifolium	Indian hemp	o		forb	promote
Asclepias incarnata	swamp milkweed	i,o		forb	promote
Aster novae-angliae	New England aster	o		forb	promote
Cirsium arvense	Canada thistle	o	e	forb	remove immediately
Epilobium coloratum	eastern willow herb	i		forb	promote
Erigeron philadelphicus	daisy fleabane	o	e	forb	promote
Euthamia graminifolia	grass-leaved goldenrod	o		forb	promote
Lycopus americana	Am. water hore hound	i		forb	promote
Lythrum salicaria	purple loosestrife	i	e	forb	remove immediately
Melilotus alba	white sweet clover	o	e	forb	remove immediately
Saxifraga pennsylvanica	Penn. Saxifrage	i		forb	promote
Solidago canadensis	Canada goldenrod	o		forb	promote
Sonchus uliginosus	sow thistle	o	e	forb	
Cornus sericea	Red osier dogwood	i,o		shrub	promote
Rhamnus cathartica	common buckthorn	i,o	e	shrub	remove immediately
Rhamnus frangula	glossy buckthorn	i,o	e	shrub	remove immediately
Salix eriocephala	diamond willow	i,o		shrub	
Salix exigua	sand bar willow	i,o		shrub	
Salix gracilis (pedicellaris)	slender willow	i,o		shrub	
Viburnum trilobum	highbush cranberry	i,o		shrub	
Fraxinus pennsylvanica	green ash	i,o		tree	
Salix x rubra	hybrid black willow	i,o	e	tree	
Ulmus americana	American elm	o		tree	
Parthenocissus vitacea	Virginia creeper	o		climber	
Vitis riparia	river grape	o		climber	

Table 4: Desnoyer Seep Plant List: partial list of plants in woods outside of Seep

scientific name	common name	exotics	lifeform	recommendation
Carex blanda	woodland sedge		graminoid	promote
Dactylus glomerata	orchard grass	e	graminoid	
Poa compressa	Canada bluegrass	e	graminoid	
Poa pratensis	Kentucky bluegrass	e	graminoid	
Setaria viridis	green millet	e	graminoid	
Aralia nudicaulis	wild sarsaparilla		forb	promote
Arctium minus	burdock	e	forb	remove immediately
Eupatorium rugosum	white snakeroot		forb	promote
Glechoma hederacea	creeping charlie	e	forb	
Hydrophyllum virginianum	Virginia waterleaf		forb	promote
Impatiens capensis	spotted jewelweed		forb	promote
Laportea canadensis	wood nettle		forb	promote
Cichorium intybus	chicory	e	forb	
Melilotus alba	white sweet clover	e	forb	
Oenothera biennis	common evening primrose		forb	promote
Prenanthes alba	white wild lettuce		forb	promote
Sanguinaria canadensis	bloodroot		forb	promote
Verbena hastata	common vervain		forb	promote
Rhus typhina	staghorn sumac		shrub	
Sorbus indecora	mountain ash	e	shrub	
Rhamnus cathartica	common buckthorn	e	shrub	remove immediately
Acer negundo	box elder		tree	
Acer saccharinum	silver maple		tree	promote
Fraxinus pennsylvanica	green ash		tree	promote
Juglans nigra	black walnut		tree	promote
Juniperus virginiana	eastern red cedar		tree	
Populus deltoides	eastern cottonwood		tree	
Quercus macrocarpa	bur oak		tree	promote
Quercus rubra	red oak		tree	promote
Tilia americana	basswood		tree	promote
Ulmus americana	american elm		tree	
Clematis virginiana	virgin's bower		climber	promote

Appendix A: Fact Sheets for Selected Invasive Species

Common Cattail (*Typha latifolia*)
Narrow-Leaved Cattail (*Typha angustifolia*)

(Source: Wisconsin Department of Natural Resources)

DESCRIPTION: The velvety, brown flower head and long, graceful, lanceolate leaves of the cattail are a common site throughout Wisconsin wetlands. The flower head, shaped like an elongate cylinder, is a compact spike at the terminal end of a stem 1-3 meters tall. The flower spike is divided into two readily distinguishable parts: pistillate flowers form the conspicuous brown club located below the yellow spire of staminate flowers. The leaves originate at the base of the stem and spread outward as they rise into the air. Below ground, starchy rhizomes anchor the plant to the soil. If the plants are growing in a colony, their rhizomes may become intertwined and form a dense mat.

Of the two species of cattail that exist in Wisconsin, common cattail is taller and generally more robust than the narrow-leaved variety. Observation of the flower spike also helps distinguish the two species. The pistillate and staminate flowers of the common cattail emerge in direct contact with one another, with no gap separating the male and female flower parts; on the flower spike of the narrow-leaved cattail, the pistillate and staminate flowers are separated by a gap 2-10 centimeters in length.

DISTRIBUTION AND HABITAT: The common cattail is a native, opportunistic North American wetland species. The narrow-leaved cattail is possibly an exotic or hybrid.

Cattails can be found in damp soil or shallow water where sufficient nutrients are available. It is a common site along expressways, in artificial ditches and shallow ponds, at the edges of calm waters, in consistently damp patches of rural and suburban yards, and in freshwater marshes. This prolific plant plays an important role as a source of food and shelter for different marsh-dwelling animals, especially when cattails form large stands on relatively open, wet soils abutted by water.

LIFE HISTORY AND EFFECTS OF INVASION: Cattails reproduce sexually by seed and vegetatively by the production of rhizomes. The flower head of the parent plant can produce 250,000 seeds, which are then wind-dispersed. Seeds remain viable in the seed bank for up to 100 years. Cattail seeds prefer freshwater, and will not germinate unless saturated in at least 0.5-1 inch of water. Sunlight affects germination rates; seeds will remain quiescent if the area does not receive the proper amount of sunlight.
Cattails also reproduce asexually by rhizomes. During the first summer of vegetative propagation, rhizomes grow about two feet in length. New shoots emerge at the rhizome around mid-summer. Cattails can quickly dominate a wetland plant community and produce monotypic stands that reduce the overall habitat value.

Narrow-leaved Cattails

CONTROLLING CATTAILS:
The acreage of cattail-dominated wetlands in the United States has increased drastically since the early twentieth century due to changes in hydrology and land use. The optimal control technique for a given site will depend on the hydrologic state of the site, the size of the area to be managed, and if the manager is able to manipulate water levels.

Mechanical Control:
Water Level: The control of cattails by the manipulation of water level must be timed to the annual cycle of carbohydrate storage. Special leaf and stem cells called aerenchyma provide air passage from both living and dead leaves to the rhizomes. Removing dead leaves and submerging the shoots in early spring will strain the plant and eventually kill it. The depth of water necessary to kill the plants depends on temperature, the quantity of starch the plant stored the previous year, and the general vigor of the plants. Therefore, no minimum water depth can be prescribed, but, generally, a water level maintained at 3-4 feet above the tops of existing spring shoots will retard growth. It is critical to remember that even if dead leaves from the previous year are completely removed, aerobic conditions will be restored to the rhizome as soon as the new growing shoot penetrates the water surface. Even if water levels are sustained at only a few inches above the tops of the growing shoots, oxygen is prevented from reaching the rhizomes. The use of water is most efficient if the water level is raised progressively, so that all plant parts remain submerged by no more than a few inches. Water levels in the range of four to five feet also favor the wintertime survival of muskrats in flooded areas. Population levels of ten muskrats per acre, when combined with high springtime water levels, can nearly eliminate the emergence of cattails within a span of two years.

Cutting, Crushing, Shearing, and Discing: Starch reserves in the rhizomes are at their minimum in late spring when the pistillate spike of the cattail is lime green and the staminate spike is dark green. This is the best time to employ cutting, crushing, shearing, and/or discing to eliminate cattail colonies because all these methods impede starch storage during the growing season. The methods of control work best if employed during

a three-week time window beginning one week before and ending one week after the staminate spike has emerged.

Deep discing can retard shoot formation and damage the rhizomes, but should be used in combination with water-level control and the prevention of seed establishment to effectively hinder the re-emergence of cattails. Discing combined with continued drying and freezing in fall decreases plant survival; if a wetland can be kept dry enough to repetitively disk for 2-3 successive seasons, cattails can be eliminated or their stem densities severely reduced. However, discing has some major drawbacks: the equipment and personnel needed to carry out this method of control are costly, and will seriously disturb the site. This will likely result in the loss of other native plants in the area as well.

Cutting, crushing, shearing, or discing severs the aerenchyma link that provides oxygen between the rhizomes and leaves of cattails during dormancy. These techniques must be combined with high springtime water levels in order to effectively retard plant growth. Cattails can be cut with a rotary mower or sheared with a front-end loader on a tractor when equipment can be driven on ice, but airborne seeds may clog equipment. High water levels must be maintained throughout the spring and early summer.

Bulldozer: Bulldozers can effectively remove plants from a marsh, but will generally drastically disturb the wetland. Permits must be obtained before clearing a marsh with heavy equipment. A bulldozer or or other machinery is the only viable method that will remove floating cattail mats, but these removal methods are also costly, and effects may be short-lived. If the seed bank of the marsh is dominated by cattails, a new colony of the hardy plants may spring up after the next drawdown of the marsh; other undesirable plants could also take the place of the cattails in the marsh.

Grazing: Grazing by cows, geese, muskrats, and other animals can be an effective method of cattail management. Grazing on seedlings and young cattails without extensive rhizomes can reduce the stem density of the colony. For mature plants, grazing combined with water-level management reduces survival rates. To maximize the impact of grazing, it should be heaviest during the three-week window of time when the flower spikes are emerging.

Prescribed Burning: Most cattail marshes must be burned in winter or before significant growth has occurred in spring; these are generally the only times when fuels are dry enough to carry a fire, although frozen ground or saturated soil may impede the fire's progress through the cattail duff. Fire is most effective as a control method when followed by naturally or artificially high water levels in the spring to smother residual stalks.

During times of drought, cattail stands overlying well-developed peat soils can be eliminated by burning. Because such fires burn peat, the ability to smother the fire by reflooding the marsh must exist before a prescribed burn can be implemented. Peat fires can also cause undesirable changes in the marsh environment, such as destruction of the seed bank, loss of peat, and air pollution.

Chemical Control: Application in mid to late summer enhances the effectiveness of translocated herbicides, although the herbicides will have little effect on seed production during the year of application. A hemi-marsh may be created if some cattails survive, although the ability of the marsh to persist in this condition depends on the manipulation of water levels. Water level control to minimize recruitment from the seed bank must be used to ensure cattails will not return once reduced by herbicides.

Herbicides can be detrimental to wetlands habitats--be sure to use herbicides that readily break down in water, soil, or substrate, such as glyphosate formulated for use over water. Boom or wick applications by ground or air boat are best for small areas where pesticide drift is a concern. Aerial applications may be used on large areas. Herbicidal control of cattails may be costly, although actual application of the herbicide usually represents a small fraction of this cost. One area manager found that an aerial application of glyphosate during August was effective in controlling cattails, dogwood, and willow, but quite costly at $110/acre. Due to the possibility of fish contamination, notice must be posted before spraying, and can be done only by a person licensed to apply herbicides.

Purple loosestrife – *Lythrum salicaria*

(Source: Minnesota Department of Natural Resources)

Controlling purple loosestrife with herbicides

When: Plan on spraying in mid-summer through early fall (July 1 - September 1) because the herbicides are most effective at this time and purple loosestrife plants are easily identified. Treat as soon as possible after loosestrife begins to flower. This will minimize seed production. If plants are already well-established at the site, there is probably already a high density of viable seeds in the soil. The disadvantage of treating early in the season is that loosestrife plants are difficult to locate because they are not in flower.

Permits: If purple loosestrife is located in or along a water course, lake basin or wetland, a permit is probably required for control work. An Aquatic Nuisance Control (ANC) permit is required for chemical control of purple loosestrife within the boundaries of the state's protected waters. When treating loosestrife, there is no fee for this permit. Contact your local DNR office if you aren't sure if the lake, stream or wetland is protected and whether a permit is needed or check the permit pages for more details.

Applications for an Aquatic Nuisance Control permit may be made by the riparian owner on that body of water or by a representative of a group of riparian owners, such as a lake association.

Sprayers: Use only a plastic or stainless steel sprayer. Use clean water, check your sprayer for leaks and adjust the nozzle to provide a spray of fine droplets. Do not adjust to a mist, since a fine mist is likely to drift and kill desirable vegetation.

Weather: Treat when rain is not expected for at least 8 hours, preferably 24 hours, and treat only during mid-morning to afternoon (wait until the dew is off and the plants are dry). Do not treat on windy days. Refer to herbicide labels for wind and temperature limitations.

Mixing: Follow the instructions on the label of the herbicide you purchase. For example - Rodeo and Pondmaster: Mix a 1% solution (1 1/3 ounce Rodeo per gallon of clean water) and .25% of Ortho X-77 Spreader (1/3 ounce per gallon).

Apply Herbicide: Wet about 1/4 to 1/2 of the leaf areas of each plant (a "clump" of loosestrife is an individual plant), taking care to avoid spraying other species. Often loosestrife is taller than the surrounding vegetation, so you can spray the top of the plant. Many plants require only one brief squirt of herbicide

Planning: Work through the colony starting at one side and backing away from the

area you have sprayed to avoid walking through the wet herbicide. For larger patches, tie some bright colored flags to tall plants to mark the boundaries of the areas that have been treated.

Signs: If the treatment is carried out on Minnesota public waters or wetlands, you need to post "Loosestrife Control Site" signs in the treated area to serve notice to anyone who may use the area for water recreation. Use restrictions vary depending on the herbicides and how they are used. Signs are provided by the DNR when the Aquatic Nuisance Control (ANC) permit is issued.

Revisit: Revisit the wetland each year to kill any surviving plants and new seedlings to prevent invasion. Also watch any areas where soil disturbances or exposed mud flats may provide a site for seedling establishment.

Aquatic Herbicides

Glyphosate herbicides are very effective for killing purple loosestrife. Glyphosate is available under the trade names Roundup, Rodeo, Pondmaster and Eagre. Only aquatic formulations of Glyphosate may be used to control purple loosestrife at aquatic sites (such as Rodeo, Pondmaster and Eagre). Roundup can only be used on upland areas for vegetation control. Glyphosate is nonselective; however, selective application techniques allow it to be used effectively with minimum damage to desirable plants. It is taken up through the leaves or young stems and will kill any plant that it is applied to. Therefore, treat only the loosestrife plants and avoid contact with valuable wetland plants such as cattails. Glyphosate is biodegradable, very short-lived and becomes quickly inactivated when it contacts moist soil.

Aquatic formulations of Glyphosate may be mixed with Ortho X-77 Spreader, or another approved wetting agent, to improve control. Roundup, which is useful in dry (non-aquatic) sites is readily available at most feed and garden stores. Rodeo is only sold in large quantities and by very few dealers. Pondmaster is available in smaller quantities. If you need to control purple loosestrife in standing water, contact the DNR Purple Loosestrife Program for help in obtaining the herbicide or for a current list of dealers and licensed commercial applicators.

The overall objective when controlling purple loosestrife with glyphosate herbicide is to spray very carefully so the loosesrife plants are selectively removed but the surrounding desirable vegetation are not harmed. If this can be accomplished most of the loosestrife will be controlled. The relatively small "holes" in the vegetation will be quickly filled by other plants precluding the establishment of loosestrife seedlings. Follow-up treatment is needed each growing season since some plants will be missed, new seedlings will sprout, and a few plants will survive the initial treatment. Improper mixtures and careless application, however, inevitably kills more surrounding vegetation and leads to the establishment of more loosestrife seedlings.

Triclopyr, a broadleaf herbicide, can be effective on loosestrife, when used from late

May through September. This herbicide is more selective and will not harm harm monocot species such as cattails. Renovate is the aquatic formulation of triclopyr that can be used to control loosestrife in Minnesota. This product however, is sold by very few dealers and in large quantities.

Common reed – *Phragmites australis*

Source:
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What is *Phragmites*?

Phragmites australis, common reed, is an aggressive, native, 8-16 foot tall, coarse perennial grass which frequently grows in the moist soils of tidal and nontidal wetlands. It has invaded many marshes throughout the Chesapeake Bay region by forming dense stands which crowd out other native marsh plants. Its status as a facultative wetland species (i.e., adaptable to a variety of wetland types) means that the habitat it occupies is most likely a wetland subject to federal, state, county or municipal regulation. However, *Phragmites* also grows well in moist upland soils.

Does *Phragmites* have any value?

Like all wetland vegetation, *Phragmites* provides food and habitat for some organisms (e.g., rails, muskrats, white-tail deer), serves to stabilize soils against erosion, and improves water quality by filtration and nutrient removal.

Why is *Phragmites* considered to be a problem?

Ecologically, *Phragmites* can be a problem plant because it is an excellent colonizer of disturbed soils and once established it usually crowds out all other wetlands plants. This reduces the ecological value of the wetland by displacing plant assemblages which have better value as habitat, for stabilizing sediment, or improving water quality through nutrient removal. Along shorelines, dense stands of *Phragmites* are objectionable because they obscure water views and encroach on naturalized and ornamental plantings.

Under what conditions should *Phragmites* control be considered?

Since the objection to *Phragmites* is its ability to reduce marsh diversity, the management objective of a control program should be to return wetlands dominated by *Phragmites* to the condition prior to *Phragmites* establishment. Thus, management strategies must include replacement efforts as well as control measures.

Is *Phragmites* a new problem?

Yes. While *Phragmites* is an efficient colonizer of disturbed soils, it does not easily invade vegetated areas. The increase in *Phragmites* correlates well with increased marsh disturbance from activities such as road expansion, ditching, shoreline development, pond construction, wetlands creation, and dredge spoil disposal.

How can *Phragmites* be controlled?

At present, the only practical method for controlling moderate to large populations of *Phragmites* is the use of the EPA approved herbicide Rodeo, active ingredient glyphosate. When used according to the manufacturer's (Monsanto Inc., St. Louis, MO) label instructions, this product has been shown to be safer and more effective than all other alternatives. Additional environmental protection can be afforded by proper timing of application and the selection of conservative application equipment. Recruitment of replacement vegetation is greatly enhanced by removing dead *Phragmites* either by burning or mowing.

***Phragmites* appears very robust, does it have any weaknesses?**

Yes. *Phragmites*, while a very hardy plant, has two weaknesses which should be exploited in management programs. The first weakness, its poor ability to invade vegetated soils, can be exploited for avoiding *Phragmites* establishment by minimizing disturbance and quickly vegetating sites which have been disturbed. This can be accomplished by seeding, plantings, or management to encourage rapid establishment of other types of plants. Sometimes additional management is needed to suppress any *Phragmites* growth that may occur in small patches. The second weakness is *Phragmites'* tendency to continue growing when many other wetlands plants have entered fall dormancy. Herbicide applications at this time kill *Phragmites* but do not significantly affect adjacent or underlying desirable species, if proper application procedures are followed.

What alternatives to herbicidal control have been evaluated?

Removal by excavation - *Phragmites* deeply penetrates many soils and for proper control all *Phragmites* must be removed. This is very expensive and will only be effective if all underground portions are removed during excavation. More importantly, this technique literally destroys the wetland type that was to be restored. The wetland which was the basis for control becomes an open water pond.

Smothering by black plastic - Coverage by black plastic kills plants by depriving them of their ability to make new food, a process which requires light. To be effective for *Phragmites* control, the plants must remain completely covered for a minimum of three growing seasons until all food reserves are depleted and the plant starves. To cover *Phragmites* with plastic requires the area to be cut to a height of

less than three inches. Problem 1: Unfortunately, after covering, the plant produces new pointed buds which easily puncture plastic film up to the thickness of swimming pool liners. Problem 2: In the spring and fall, the plastic warms the soil thus making it attractive to small animals like frogs and mice. Large predators like raccoons and foxes tear through the plastic to feed, thereby exposing *Phragmites* to the light it needs. Problem 3: During the summer, the moist soils heat excessively which kills the soil organisms and "good" seed stocks. In summary, this technique does not work and does more harm to the environment than the herbicide alternative.

Repeat harvesting - This technique like black plastic starves plants, not by excluding light, but by continuously removing the green tissues which use light to make the plant's food. To be effective, the *Phragmites* stands must be mowed for a minimum of two growing seasons throughout the growing season as new leaves appear. In principle, this alternative is effective; however, in practice few mowing machines are available which can work in wetlands during the wet season. Any regrowth of *Phragmites* during these periods renders this technique ineffective.

Flooding - Flooding kills many types of plants. It does not kill many types of wetlands plants unless the water is very deep. *Phragmites* has not been controlled in some areas flooded with 10 feet of water for one year. This treatment did kill other types of desirable wetlands vegetation.

Biological controls - No biological controls have been identified for *Phragmites*.

Burning only - Burning by itself does not work and in fact encourages more vigorous *Phragmites* growth.

What are the elements of a comprehensive Phragmites control program?

Despite procedural variations between regulatory agencies, the components of successful management plans are remarkably consistent. Management plans must provide a rationale for controlling *Phragmites*, evaluate existing site conditions which may affect control, describe the procedures to be used, and identify all regulatory requirements.

Canada thistle (*Cirsium arvense*)

(Source: Minnesota Department of Natural Resources)

Description:

Appearance: Perennial herbaceous plant, 2 - 5' tall with slender grooved stems that branch only at the top. It has male and female plants.

Leaves: Alternate, smooth, oblong, tapering, and directly attached to the stem, deeply divided, with prickly margins.

Flowers: Numerous small purple flowers appear on top of the upper branched stems between June and September.

Seeds: Small light brown seeds are tufted for dispersal by the wind. Seeds remain viable in the soil for over 20 years.

Roots: Each plant has a fibrous taproot with wide spreading horizontal roots. Each small section of root can form a new plant enabling the plant to spread vegetatively.

Ecological Threat:

- Canada thistle invades natural areas such as prairies, savannas, glades and dunes if some degree of disturbance already exists. It also invades wet areas with fluctuating water levels such as streambanks, sedge meadows and wet prairies.
- Once it has established itself it spreads quickly replacing native plants, diminishing diversity. It grows in circular patches spreading vegetatively through horizontal roots which can spread 10 -12' in one season.

- Canada thistle occurs throughout the northern U.S. from northern California to Maine and southward to Virginia and in Canada.
- It has been declared a noxious weed in 43 states as one of the most tenacious agricultural weeds.
- Canada thistle is on the MDA **Prohibited noxious weeds** list in Minnesota.

Control Methods:

Mechanical

Repeated pulling and mowing will weaken roots, mowing when flower buds are just about to open

Late spring burns May/June are most detrimental, but also stimulate seed germination; burn consecutively for 3 years

Chemical

Spot application with glyphosate or with selective herbicide clopyralid, or metsulfuron

Biological

Stem weevil, bud weevil and stem gall fly are commercially available

Reed canary grass *(Phalaris arundinacea)*

(Source: Minnesota Department of Natural Resources)

Description:

Appearance: Perennial coarse cool season grass that grows 2 - 6' high. It had been especially selected for its vigor, and is one of the first to sprout in spring. Erect hairless stems.

Leaf blades: 1⁄4"-1⁄3" wide, gradually tapering, up to 10" long. It has a highly transparent ligule (a membrane where blade and sheath meet) which distinguishes it from the native bluejoint grass.

Flowers: Densely clustered single florets, green to purple changing to beige over time, blooms May to mid-June.

Roots: Reproduces vegetatively through horizontal stems growing below the soil surface, called rhizomes, creating a thick impenetrable mat at or directly below the soil surface.

Ecological Threat:

- Reed canary is a major threat to natural wetlands. It out competes most native species.
- It presents a major challenge in wetland mitigation efforts.
- It forms large, single-species stands, with which other species cannot compete.
- If cut during the growing season a second growth spurt occurs in the fall.
- Invasion is associated with disturbances, such as ditch building, stream channeling sedimentation and intentional planting.
- This Eurasian species has been planted throughout the U.S. since the 1800s for

forage and erosion control. It is still being planted.

Control Methods:

Mechanical
Consecutive annual burns spring or fall
Mowing mid-June and October to reduce seed and encourage native species
Frequent cultivation followed by fall seeding

Chemical
Application of glyphosate (Rodeo)
Preliminary research indicates that fall chemical application may be most effective