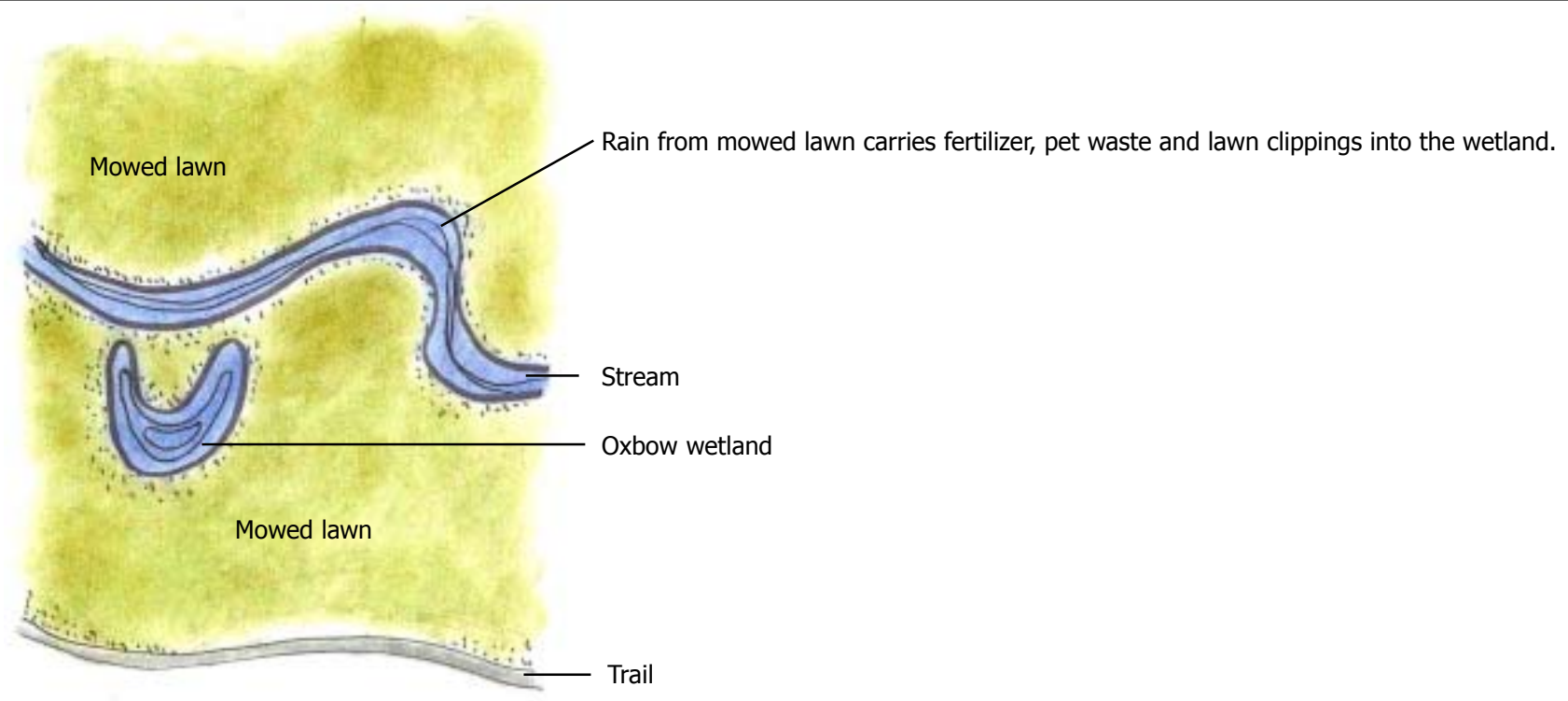
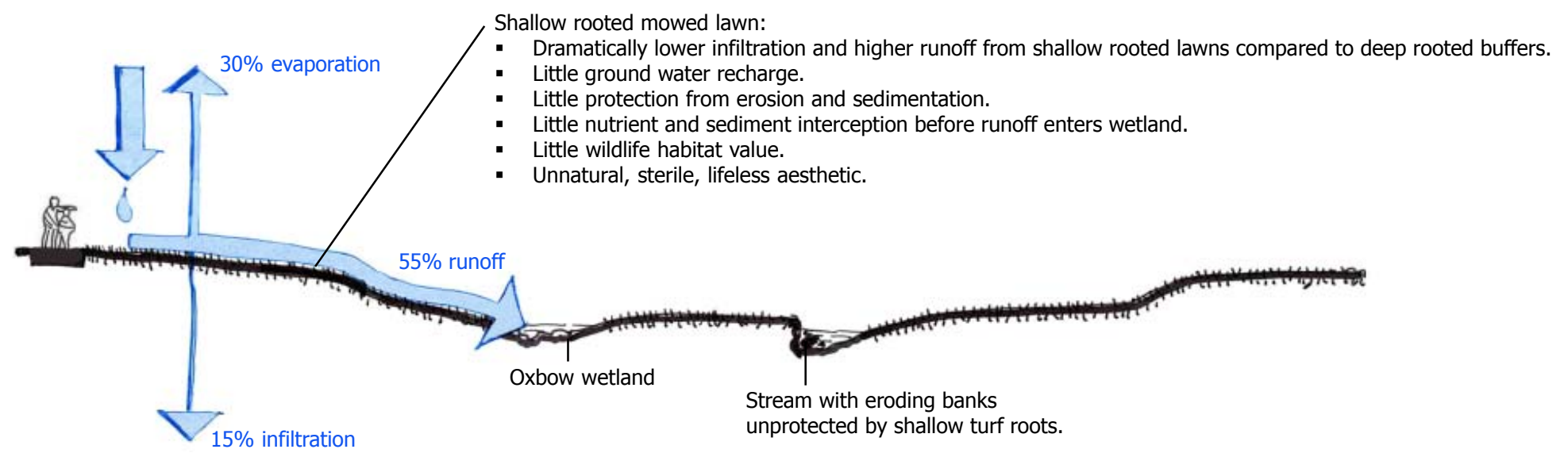


TYPICAL  
STREAM PLAN  
WITHOUT  
BUFFER



TYPICAL  
STREAM  
SECTION  
WITHOUT  
BUFFER



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STREAM BUFFER TEMPLATE

Sheet 1 of 5  
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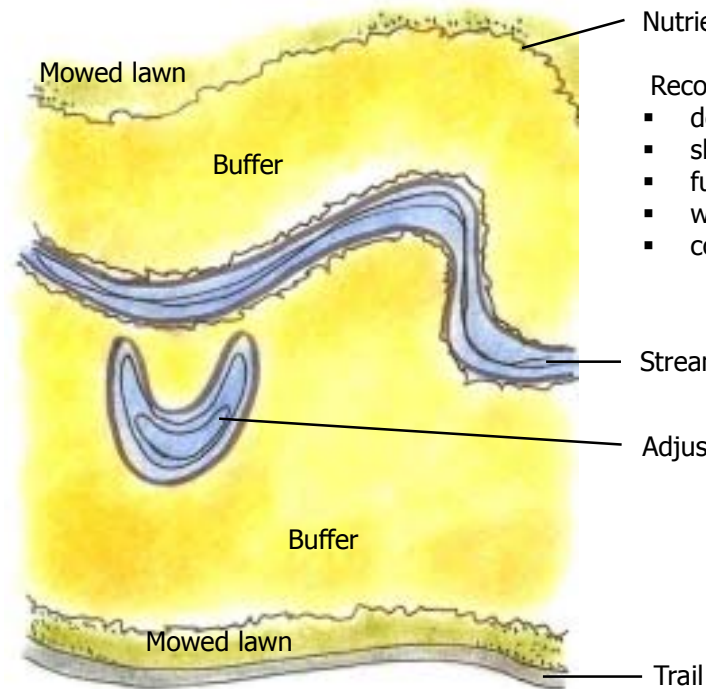
Prepared for:  
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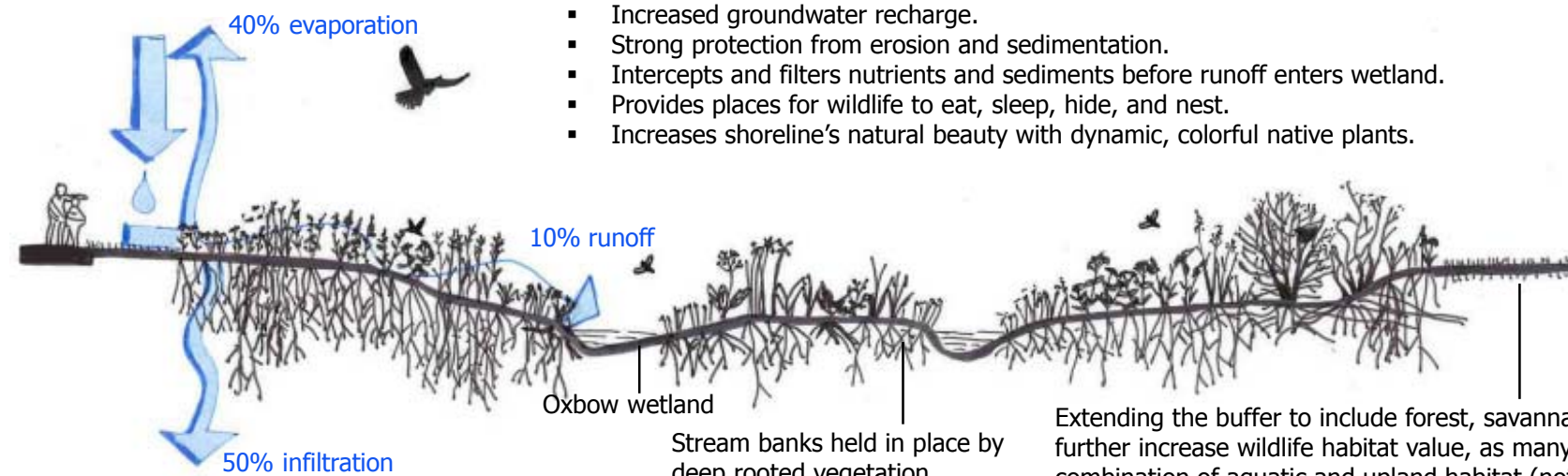


# TYPICAL STREAM PLAN WITH BUFFER



- Nutrients in runoff from mowed lawn intercepted by buffer vegetation.
- Recommended buffer width varies depending on many factors, such as, for example,
- desired buffer functions
  - shoreline slope and soil erodibility
  - functions and values of the receiving water, e.g. sensitivity to disturbance
  - watershed characteristics
  - context in watershed.
- Adjust buffer width to include adjacent wetlands and any other contiguous critical habitats.

# TYPICAL STREAM SECTION WITH BUFFER



- Deep-rooted buffer:
- Dramatically higher infiltration and lower runoff from deep rooted buffer compared to mowed lawn.
  - Increased groundwater recharge.
  - Strong protection from erosion and sedimentation.
  - Intercepts and filters nutrients and sediments before runoff enters wetland.
  - Provides places for wildlife to eat, sleep, hide, and nest.
  - Increases shoreline's natural beauty with dynamic, colorful native plants.
- Stream banks held in place by deep rooted vegetation.
- Extending the buffer to include forest, savanna, or prairie habitat will further increase wildlife habitat value, as many wildlife species need a combination of aquatic and upland habitat (not shown).

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# COMMON STREAM BUFFER PLANTS

## NATIVE BUFFER PLANTS - HERBACEOUS

| Scientific Name                  | Common Name          | Sun or Shade              | Height (ft.) | Moisture Regime |
|----------------------------------|----------------------|---------------------------|--------------|-----------------|
| <i>Andropogon gerardii</i>       | Big Bluestem         | Sun, partial shade        | 2-6          | um, ud          |
| <i>Arisaema triphyllum</i>       | Jack in the Pulpit   | Partial shade, shade      | 1-2          | w, um           |
| <i>Asarum canadense</i>          | Wild Ginger          | Partial shade, shade      | 0.5          | um              |
| <i>Aster macrophyllus</i>        | Large Leaved Aster   | Sun, partial shade, shade | 1-2          | um, ud          |
| <i>Aster novae-angliae</i>       | New England Aster    | Sun, partial shade, shade | 3-5          | w, um           |
| <i>Aster umbellatus</i>          | Flat-Topped Aster    | Sun, partial shade        | 3-4          | w, um           |
| <i>Carex bebbii</i>              | Bebb's Sedge         | Sun, partial shade        | 2            | w, um           |
| <i>Carex comosa</i>              | Bottlebrush Sedge    | Sun, partial shade        | 3            | f, w            |
| <i>Carex crinita</i>             | Fringed Sedge        | Sun, partial shade        | 3            | f, w            |
| <i>Carex vulpinoidea</i>         | Fox Sedge            | Sun, partial shade        | 1-3          | w, um           |
| <i>Elymus hystrix</i>            | Bottlebrush Grass    | Partial shade, shade      | 2-4          | w, um, ud       |
| <i>Elymus virginicus</i>         | Virginia Wild Rye    | Sun, partial shade        | 2-4          | w, um           |
| <i>Eupatorium maculatum</i>      | Joe Pye Weed         | Sun, partial shade        | 3-6          | w, um           |
| <i>Eupatorium perfoliatum</i>    | Boneset              | Sun, partial shade        | 2-4          | w, um           |
| <i>Helenium autumnale</i>        | Sneezeweed           | Sun, partial shade        | 2-5          | w, um           |
| <i>Hydrophyllum virginianum</i>  | Virginia Waterleaf   | Partial shade, shade      | 1            | um              |
| <i>Liatris ligulistylus</i>      | Meadow Blazing Star  | Sun, partial shade, shade | 2-3          | w, um           |
| <i>Lobelia siphilitica</i>       | Blue Lobelia         | Sun, partial shade        | 1-3          | w, um           |
| <i>Lobelia cardinalis</i>        | Cardinal Flower      | Partial shade, shade      | 2-4          | w               |
| <i>Matteuccia struthiopteris</i> | Ostrich Fern         | Shade                     | 2-4          | w, um           |
| <i>Onoclea sensibilis</i>        | Sensitive Fern       | Sun, partial shade        | 2            | w, um           |
| <i>Osmunda claytoniana</i>       | Interrupted Fern     | Partial shade, shade      | 3-4          | w, um           |
| <i>Physostegia virginiana</i>    | Obedient Plant       | Sun, partial shade, shade | 2-4          | f, w, um        |
| <i>Podophyllum peltatum</i>      | May Apple            | Partial shade, shade      | 1-2          | um              |
| <i>Silphium perfoliatum</i>      | Cup Plant            | Sun, partial shade        | 4-7          | w, um           |
| <i>Smilacina racemosa</i>        | False Solomon's Seal | Partial shade, shade      | 2            | um              |
| <i>Solidago flexicaulis</i>      | Zig-Zag Goldenrod    | Partial shade, shade      | 1-2          | um, ud          |
| <i>Solidago rigida</i>           | Rigid Goldenrod      | Sun, partial shade        | 1-5          | um, ud          |
| <i>Spartina pectinata</i>        | Prairie Cord Grass   | Sun                       | 4-6          | w, um           |
| <i>Thalictrum dioicum</i>        | Early Meadow Rue     | Partial shade, shade      | 1-2          | um              |
| <i>Verbena hastata</i>           | Blue Vervain         | Sun, partial shade        | 2-5          | w, um           |

## NATIVE BUFFER PLANTS - TREES AND SHRUBS

| Scientific Name                        | Common Name          | Sun or Shade              | Height (ft.) | Moisture Regime |
|--|----------------------|---------------------------|--------------|-----------------|
| <i>Acer rubrum</i>                     | Red Maple            | Sun, partial shade        | 40-60        | w, um           |
| <i>Alnus incana</i> spp. <i>rugosa</i> | Speckled Alder       | Sun, partial shade        | 15-30        | w               |
| <i>Aronia melanocarpa</i>              | Black Chokeberry     | Sun, partial shade, shade | 3-6          | w, um, ud       |
| <i>Betula nigra</i>                    | River Birch          | Sun                       | 50-70        | w, um, ud       |
| <i>Celtis occidentalis</i>             | Hackberry            | Sun, partial shade        | 60-100       | um              |
| <i>Cephalanthus occidentalis</i>       | Button Bush          | Sun, partial shade        | 6-12         | f, w            |
| <i>Cornus sericea</i>                  | Red Osier Dogwood    | Sun, partial shade, shade | 6-12         | w, um, ud       |
| <i>Populus deltoides</i>               | Eastern Cottonwood   | Sun, partial shade        | 90           | w, um, ud       |
| <i>Quercus bicolor</i>                 | Swamp White Oak      | Sun, partial shade        | 75-100       | w, um           |
| <i>Salix exigua</i>                    | Sandbar Willow       | Sun                       | 5-9          | f, w            |
| <i>Salix humilis</i>                   | Prairie Willow       | Sun                       | 3-9          | w, um, ud       |
| <i>Sambucus canadensis</i>             | Common Elderberry    | Sun, partial shade, shade | 3-12         | w, um           |
| <i>Sambucus pubens</i>                 | Red Elderberry       | Partial shade, shade      | 8-10         | um              |
| <i>Spiraea alba</i>                    | Meadowsweet          | Sun, partial shade        | 2-5          | f, w            |
| <i>Thuja occidentalis</i>              | Northern White Cedar | Sun, partial shade        | 40-60        | w, um           |

## INTRODUCED PLANTS AND CULTIVARS

| Scientific Name                   | Common Name                | Sun or Shade         | Height (ft.) | Moisture Regime |
|-----------------------------------|----------------------------|----------------------|--------------|-----------------|
| <i>Anemone</i> spp.               | Anemones                   | Sun, partial shade   | 1-3          | um              |
| <i>Astilbe</i> spp.               | Astilbe                    | Sun, partial shade   | 1.5-3        | um              |
| <i>Brunnera macrophylla</i>       | Brunnera                   | Partial shade, shade | 1-1.5        | w, um, ud       |
| <i>Calamagrostis x acutiflora</i> | 'Karl Foerster'            | Partial shade, shade | 4-5          | um, ud          |
| <i>Hemerocallis</i> spp.          | Daylilies                  | Sun, partial shade   | 1-5          | um              |
| <i>Hosta sieboldiana</i>          | Hosta                      | Partial shade, shade | 2-3          | um              |
| <i>Iris sibirica</i> varieties    | Siberian Irises            | Sun, partial shade   | 1.5-3.5      | um, w           |
| <i>Ligularia dentata</i>          | Bigleaf Goldenray          | Partial shade, shade | 2.5-5        | um              |
| <i>Paeonia</i> spp.               | Peonies                    | Sun, partial shade   | 1-4          | um              |
| <i>Pennisetum alopecuroides</i>   | Fountain Grass             | Sun                  | 3-4          | um, ud          |
| <i>Rudbeckia fulgida</i>          | Goldsturm Black Eyed Susan | Sun                  | 1.5          | um              |

## COVER CROPS

Cover crops are fast growing annual plants, typically oats (*Avena sativa*) or annual rye (*Lolium multiflorum*) that are often added to seeded buffers to reduce weed growth and prevent soil erosion until the seeded buffer is established.

## GUIDE TO ABBREVIATIONS

d: Deep water plants, typically in water 14 inches to 5 feet deep  
 f: Fringe plants; grow in shallow water less than 14 inches deep  
 w: Wet soil lakeshore plants; moist year-round  
 um: Upland moist; upland soils that are moist but not saturated  
 ud: Upland dry; upland soils that are dry and well-drained

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## GUIDELINES FOR DEVELOPING A PLANT PALETTE

- Trees, shrubs, and/or herbaceous plants suitable to the site's growing conditions can be included in the buffer plant palette. Leaving deadfalls and duff in place will also enhance the ecological functions of the buffer.
- Criteria considered in selecting buffer plants include growing conditions (sunlight exposure, soil type, hydrology, etc.), cold hardiness, rooting characteristics, maintenance requirements, plant availability, wildlife value, project goals, aesthetics and personal taste.
- Planting design style can range from naturalistic to formal.
- Maximizing plant diversity maximizes the buffer benefits listed on page 1 by maximizing root and above ground structural diversity. Natural lake buffers often have 20-100 species!
- So long as soils have not been extensively disturbed, native plants are adapted to local conditions and hence do not require artificial inputs and minimal maintenance. They also give a site a strong sense of regional identity.
- If you want to use native plants, use an analogous natural reference site to select the plant palette best suited to your site.
- Avoid planting invasive species at all costs!

*The plant lists shown in this publication do not represent the complete spectrum of potential buffer plants. Consult with a landscape professional, plant supplier, or the references listed below for additional plant recommendations:*

- Henderson, Carrol, Carolyn Dindorf, and Fred Rozumalski. Lakescaping for Wildlife and Water Quality. 1999. Minnesota Department of Natural Resources, St. Paul, Minnesota.
- MNDNR. Restore Your Shore CD. Includes interactive Plant Selection Guide. For sale from Minnesota's Bookstore in St. Paul, (651) 297-3000.
- Shaw, Daniel and Rusty Schmidt. Plants for Stormwater Design. 2003. Minnesota Pollution Control Agency, St. Paul, MN. Available for free by calling (651) 297-8679.
- Shaw, Daniel B. Native Vegetation in Restored and Created Wetlands. 2000. Minnesota Water and Soil Resources, St. Paul, Minnesota.
- Wovcha, D.S., B.C. Delaney and G.E. Nordquist. 1995. Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats. Minnesota Department of Natural Resources. University of Minnesota Press.
- Many native plant supplier catalogs are also very informative.

## POTENTIAL PLANT SUPPLIERS

Listing does not constitute endorsement.

Listing below is not an exhaustive list of suppliers.

- Bailey's Nursery, Newport, MN, (612) 459-9744
- Critical Connections Ecological Services, Inc. Nursery, Marine on St. Croix, MN, 651 433-4410
- Dragonfly Gardens, Amery, WI, (715) 268-7660, [www.dragonflygardens.net](http://www.dragonflygardens.net)
- Hild and Associates, River Falls, WI, (715) 426-5131
- Ion Exchange, Harpers Ferry, IA, (800) 291-2143, [www.ionxchange.com](http://www.ionxchange.com)
- Landscape Alternatives, Inc., Roseville, MN, (651) 488-3142
- Prairie Moon Nursery, Winona, MN, (507) 452-1362
- Prairie Restorations, Inc., Princeton, MN, (612) 389-4342
- Natural Shore Technologies, Champlin MN, (612) 703-7581, [www.naturalshore.com](http://www.naturalshore.com)
- North American Prairies, Annandale, MN, (320) 274-5316, [northamericanprairies.com](http://northamericanprairies.com).
- Shooting Star Native Seed, Spring Grove, MN, (507) 498-3944, [ssns@means.net](mailto:ssns@means.net).
- Woodland Plant Salvage Company, White Bear Township, MN, 651-426-8174

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## OTHER BUFFER COMPONENTS

- Hardwood shredded mulch: used only when planting live plants, not with seeded buffers; beneficial in controlling weeds and getting young plants established.
- Straw mulch: beneficial when seeding buffer vegetation; controls erosion and enhances seed germination.
- Mycorrhizae: sometimes beneficial in poor soils.
- Biodegradable erosion control blanket: often beneficial on eroding or steep slopes.
- Edging: edging minimum 6" wide or 6" deep, such as heavy duty black plastic edging, helps keep lawn grasses from invading the buffer.
- Vegetation protection fence: sometimes used to protect plants from intruders, dogs, and herbivores until plants are established (typically 2 years).
- Tree shelters: sometimes used to protect woody plants from herbivores until established (typically 2-3 years).
- Plant labels can be helpful to distinguish buffer plants from weeds.
- Wildlife habitat enhancements (tree snags, turtle logs, bird boxes, butterfly boxes).
- Soil bioengineering methods can also be used to address erosion problems but are not covered in this publication.

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Listing below is not an exhaustive list of suppliers.

- Hardwood shredded mulch and compost: NRG Processing, St. Paul, (612) 331-4610
- Mycorrhizae: Mycorrhizal Applications, Inc., Grants Pass, OR, (541) 476-3985, [www.mycorrhizae.com](http://www.mycorrhizae.com)
- Erosion control blanket: Brock White Company, St. Paul MN, (800) 880-3210, [www.brockwhite.com](http://www.brockwhite.com)
- Tree shelters: Treessentials Co., St. Paul, MN, (800) 248-8239; Oasis Tree Shelters, Salinas, CA, (800) 784-4769

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## MAINTENANCE

- In the first year, when plant roots are not yet fully established, water thoroughly once a week every week that it does not rain at least one inch. In the second year, water only during severe drought. After the second year, no watering will be required if using native plants adapted to local conditions.
- Invasive species should be closely monitored and removed immediately, especially in the first 3-5 years. If not promptly removed, invasive species will rapidly spread and displace desired buffer vegetation. Eradication will be very difficult, time-consuming, and costly!
- Lists of worst invasive plants are shown to the right.
- Native plants that evolved under a periodic fire regime will benefit from periodic controlled burns. Mow with a mulching mower set on the highest setting where controlled burns are not feasible.
- Ensure that runoff is spread across vegetated areas and not allowed to bypass or flow into concentrated channels.
- Avoid mowing, raking, or removing leaf litter and deadfall.
- Do not dispose of yard waste in buffer zone.
- Do not use fertilizers and pesticides in buffer zones and use in other areas only when needed.
- Limit trails and structures within 25' of stream. Where stream access is needed, use narrow pervious trails only.
- To further reduce mowing maintenance on your property, consider replacing your lawn with a no-mow turf, such as a no-mow fescue mix (not native), blue gramma (native, sandy or loamy soil).
- Use low impact development techniques throughout the watershed to minimize the negative effects of impervious surfaces on surface water bodies (e.g. collect runoff from hard surfaces in raingardens, use pervious paving on driveways and paths, disconnect downspouts from storm sewer systems, install rain barrels on downspouts).

## EXAMPLE STREAM BUFFERS

Minnehaha Creek, Minneapolis, MN; Immediately West of Cedar Ave, Local Funding by Minnehaha Creek Watershed District



Photo: The Kestrel Design Group, Inc.

Pike Creek, Maple Grove, MN; Intersection of Hemlock Lane and Red Fox Drive North, (Installed 2002)



Photo: The Kestrel Design Group, Inc.

St. Croix River Buffer at William O'Brien State Park



Photo: Sean Jergens



Photo: Sean Jergens

Minnesota Landscape Arboretum Stream Buffer, Chanhassen, MN



Photo: Nathalie Hallyn

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## INVASIVE SPECIES

### HERBACEOUS PLANTS

#### Scientific Name

*Alliaria officinalis*  
*Ambrosia trifida*  
*Botanum unbellatus*  
*Bromus inermis*  
*Centaurea maculosa*  
*Cirsium arvense*  
*Coronilla varia*  
*Euphorbia esula*  
*Iris pseudacorus*  
*Lotus corniculatus*  
*Lythrum salicaria*  
*Melilotus alba*  
*Melilotus officinalis*  
*Myriophyllum spicatum*  
*Phalaris arundinacea L.*  
*Plantago major*  
*Poa pratensis*  
*Polygonum cuspidatum*  
*Rumex crispus*  
*Typha spp.*

#### Common Name

Garlic Mustard  
 Giant Ragweed (native)  
 Flowering Rush  
 Hungarian Brome  
 Spotted Knapweed  
 Canada Thistle  
 Crown Vetch  
 Leafy Spurge  
 Yellow Iris  
 Bird's Foot Trefoil  
 Purple Loosestrife  
 White Sweet Clover  
 Yellow Sweet Clover  
 Eurasian Water Milfoil  
 Reed Canary Grass (native)  
 Plantain  
 Kentucky Bluegrass  
 Japanese Knotweed  
 Curly Dock  
 Hybrid Cattails

### WOODY PLANTS

#### Scientific Name

*Celastrus orbiculata*  
*Lonicera tatarica*  
*Morus alba*  
*Philadelphus spp.*  
*Rhamnus spp.*  
*Robinia pseudoaccacia*

#### Common Name

Oriental Bittersweet  
 Asian Honeysuckle  
 Asian Mulberry  
 Mockorange  
 Buckthorn  
 Black Locust

The following websites provide images and information about potential removal techniques for the species listed above:  
[http://www.dnr.state.mn.us/ecological\\_services/exotics/index.html](http://www.dnr.state.mn.us/ecological_services/exotics/index.html)  
<http://tncweeds.ucdavis.edu/>  
<http://www.dnr.state.wi.us/org/land/er/invasive/>

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