Shoreland Habitat Restoration

Introduction

Definition of Shoreland Habitat:

An area adjacent to a water body that is vegetated with a diverse mixture of native species that include grasses, grass-like species, forbs, shrubs, and trees.

Purposes:

- Provide habitat for aquatic and terrestrial fauna
- Enhance adjacent shallow water habitat by providing shade and overhanging vegetation and promoting natural recovery of emergent species
- Promote shoreland corridors
- Increase the presence and diversity of native species
- Reduce the environmental and visual impact of nearby human activities
- Improve water quality
- Enhance bank stability

NRCS Standard #580, Streambank and Shoreline Protection provides specific criteria for shoreline protection. It identifies the necessary components of a shoreline stabilization plan and lists criteria for operation and maintenance of the practice. This may include the need to include erosion control methods such as fabric on steep slopes and bio-logs where wave action is a concern.

Local shoreland zoning ordinances, local shoreland restoration design standards, and associated cost share program guidelines may provide additional requirements and guidance. These may include greater buffer depths, more restrictive requirements for viewing/access corridors, and plant selection.

This technical note provides detailed guidance on the following:

Vegetation Establishment Techniques

Determining the appropriate vegetation establishment technique requires an assessment of the existing vegetative cover. In many cases a combination of the two general techniques described below will be appropriate due to varying existing vegetation conditions.

Initial site assessment should include:

- Identification of any native species present and their location, density, and vigor.
- Identification of any invasive species or noxious weeds present and their location, density, and vigor.
- Assessment of the density and vigor of any turf grasses present.

Natural Recovery

Natural recovery or "no-mow" zones are encouraged where feasible. Native vegetation will recover naturally when the site is protected from disturbance and where adequate seed and/or root sources and appropriate site conditions are present. Wet shoreline margins, where turf grasses are not well established, are particularly suited to natural recovery. Results may be slower than for planted buffers, but there is virtually no cost, and the end result may appear more natural.

An area where a dense growth of turf grasses has been maintained for several years is usually not well suited to natural recovery. Turf grasses frequently out-compete native vegetation, and the area may lack native seed sources. Areas with extensive stands of invasive weeds should also not be left to recover naturally.

Accelerated Recovery — Planted Buffers

Accelerated recovery techniques are most appropriate where insufficient native vegetation is present for natural recovery techniques, or where quick results are desired. Accelerated recovery techniques can include planting trees and shrubs, planting native grass and wildflower seedlings, or seeding native grasses and wildflowers. Steps for each of these accelerated recovery-planting techniques are described later in this Tech Note.

On many sites, natural and accelerated recovery techniques can be combined. For example, natural recovery might be used along the shoreline where there are native plants, and accelerated recovery used for the remainder of the restoration, where turf grasses dominate.

Plan Components

A plan shall be developed to guide the restoration process to ensure that restoration requirements and goals for the site are met. An example plan is included in Appendix 1.

The plan shall include:

- Site diagram or map
- Preparation schedule
- Planting dates and schedule
- Care and handling of plant materials
- Watering plan
- Maintenance plan including management of invasive species
- Plant and seed calculation worksheet

Site Diagram

Appendix 2 contains the "Shoreland Habitat Plan – Site Diagram" job sheet to assist with plan development.

The site diagram must be to scale and shall include:

- Location of existing primary structures
- Boundary of the practice
- Scale (1inch = 10 feet recommended)
- North arrow
- Location of ordinary high water mark
- Location of viewing/access corridor
- Existing shrubs and trees
- Locations where shrubs and trees are to be planted
- Areas where herbaceous cover will be planted and planting density
- A species list for the site
- Location of erosion control practices to be installed during practice establishment
- Location of practices to address channelized/concentrated flow

Plant Materials

Species Selection

Plants shall be selected from species lists of plant communities that are native to the county or region. Plants should further be chosen based on site soil, moisture, and light conditions. In some cases, such as lack of plant or seed availability, substitutions may be allowed. ***MNDNR Restore Your Shore – Native Plant Encyclopedia*** is an excellent reference for plant selection. Restore Your Shore: Plant Guide: Minnesota DNR

In addition, references such as those included at the end of this document may be used to make selections.

Planting Densities

The table below describes planting standards for two major shoreland types: woodland, and barrens/dry prairie/wet prairie. The woodland has a nearly complete canopy of trees while the barrens/prairie and wetland are more open. Plant numbers are to be calculated based on the area in square feet to be reestablished and the appropriate density. The area to be reestablished shall be calculated for each layer. See Worksheet 1 for example area calculations.

Table 1. Shoreland Habitat Planting Densities

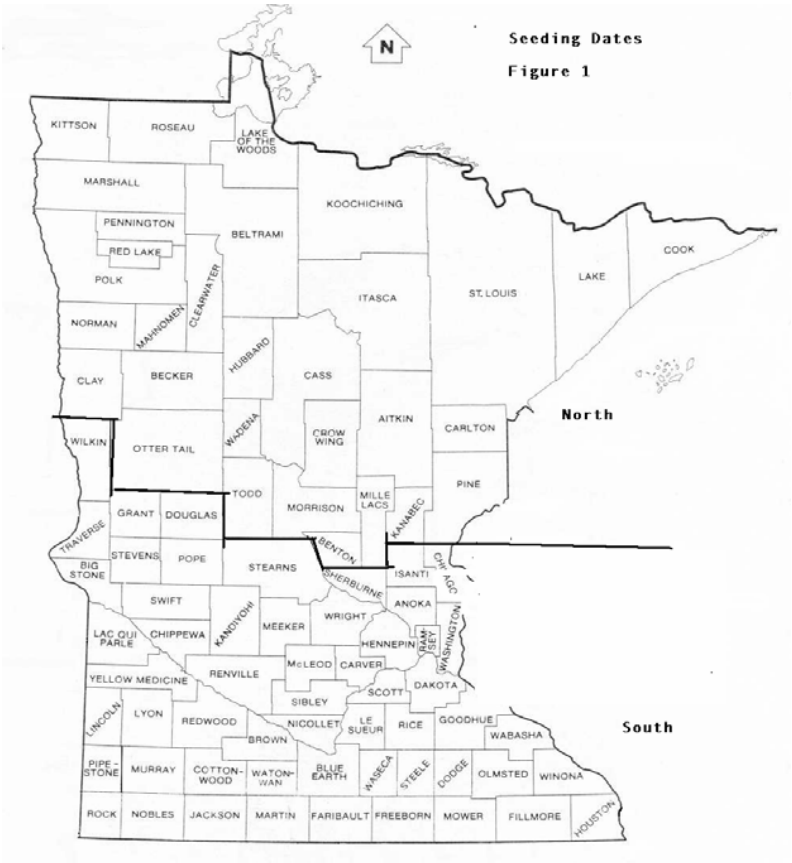
	Woodland - Upland		**Wetland - Riparian**	
	Minimum Number Of Species 1/	**Density**	**Minimum Number Of Species 1/**	**Density**
Trees 2/	2	0.5 – 5 per 100 sq. ft.	0	0 – 0.2 per 100 sq. ft.
Shrubs	3	1 – 4 per 100 sq. ft. If clumped, maintain min. 2 foot spacing	2	0.2 – 0.5 per 100 sq. ft. If clumped, maintain min. 2 foot spacing
Herbaceous Cover 3/				
Plugs	3	25 – 75 plants per 100 sq. ft. Soil must be mulched	5	50 – 100 plants per 100 sq. ft. Soil must be mulched
Seeding	3	Grass/Sedges: 4-8 oz. per 1000 sq. ft. Forbs: 2-4 oz. per 1000 sq. ft.	5 **4/**	Grass/Sedges: 4-8 oz. per 1000 sq. ft. Forbs: 2-4 oz. per 1000 sq. ft.

1/ Select species from established plant lists for shoreland habitat. Trees, shrubs, and groundcovers may be transplanted from adjacent woodland or open areas outside the restoration area.
2/ Trees must be at least 2 year old seedlings, 8 inches or taller.
3/ The herbaceous cover layer shall be comprised of a minimum of 30% grasses and/or sedges.
4/ Consider the use of plants rather than seeds in wet areas.

Planting Dates

The table below provides approximate dates for planting. Weather and soil conditions, which vary year-to-year, determine the most appropriate planting time. Please note that adequate moisture levels are assumed due to required watering practices.

Table 2. Recommended Planting Dates and Zones		
	North	**South**
Seeded Herbaceous Covers Seeding early favors cool season plants. Seeding after soil temperature increases above 50 degrees favors warm season plants.	Cool Season: April 1 – June 15 July 15 – Sept. 1 Warm Season: May 15-June 30	Cool Season: April 1 – June 1 August 1–Sept. 10 Warm Season: May 15-June 30
Plugs (seedlings) and Potted Herbaceous Covers Plant after danger of frost has passed, and up to first frost. Later plantings may require more frequent watering because of increased temperatures.	May 20 – September 15	May 1 – October 31
Bare root Trees and Shrubs	Any time soil is not frozen and before leaf out, or after leaves fall.	
Potted Trees and Shrubs	Any time soil is not frozen.	



Worksheets for Calculating Plant and Seed Needs

Worksheet 1 can be used to calculate the square footage of area to be restored for each vegetative layer. Worksheet 2 can be used to calculate the amount of trees, shrubs, plants and seeds needed.

Worksheet 1: Area Calculations							
	Total Area of Shoreline (Square Feet)		**Total Area of Viewing/Access Corridor**		**Total Area of Existing Layer to Preserve and/or Natural Recovery Zones**		**Total Area to be Planted**
Tree Layer		-		-		=	
Shrub Layer		-		-		=	
Herbaceous Layer Plants		-		-		=	
Herbaceous Layer Seeds		-		-		=	
SAMPLE 5/ Herbaceous Layer - Plants	**6,000**	**-**	**1,500**	**-**	**1,000**	**=**	**3,500**

Worksheet 2: Seed or Plant Densities							
	Total Area to be Planted (Square Feet)		**Density Factor 6/**		**Seed or Plant Densities From Table 1**		**Total Plants or Seeds to Install**
Tree Layer		÷	100	x		=	
Shrub Layer		÷	100	x		=	
Herbaceous Layer Plants		÷	100	x		=	
Herbaceous Layer Grass Seeds		÷	1000	x		=	
Herbaceous Layer Forb Seeds		÷	1000	x			
SAMPLE 7/ Herbaceous Layer - Plants	**3,500**	÷	**100**	x	**70**	**=**	**2,450**

5/ This sample is 60x100 foot restoration (6,000 sq. ft.), with a 25x60 view corridor (1,500 sq. ft), and 1,000 sq. ft. of natural recovery.

6/ See Table 1, column 3, on page 4. Trees, shrubs and plant densities are given in number of plants/100 sq. ft., and seeding densities are given in number of ounces/1000 sq. ft.

7/ Sample site is 3,500 sq. ft., to be planted at 70 plant plugs per 100 sq. ft., for a total of 2450 plants needed.

Additional Planning Considerations

Exposed soil may be encountered because of erosion from runoff, bank instability, heavy use, or construction activities. Eliminate or minimize the cause of the bare soil and then stabilize the area following the guidelines below. Filter fabric fences may be necessary to capture sediment below exposed slopes.

Companion Seeding for Steep Slopes

When seeding on steep slopes, a companion seeding and/or other erosion control practices shall be used. See companion seeding rates table below.

Slopes >12%: Companion seeding of oats, side oats grama, or Canada wild rye. **8 /**
Slopes >20%: Companion seeding of oats, side oats grama, or Canada wild rye, and use either mulch and netting or an erosion control blanket.

Table 3. Seeding Rates for Companion Crops	
Oats	0.5 lba/1000 sq. ft.
Canada Wildrye	1.0 oz. / 1000 sq. ft.
Side Oats Grama	1.0 oz. / 1000 sq. ft.

Temporary Cover Crop for Exposed Soil

A temporary cover crop should be planted only if soils have been exposed, and the restoration planting is delayed.

Table 4. Seeding Rates for Cover Crop		
	RATE	**DATE**
Oats	0.5 – 1.0 lbs/1000 sq. ft.	4/1 - 6/1
Barley	0.5 – 1.0 lbs/1000 sq. ft.	4/1 – 6/1
Annual Ryegrass	0.5 – 1.0 lbs/1000 sq. ft.	8/1 – 9/1
Sideoats Grama	0.5 – 1.0 lbs/1000 sq. ft.	5/1 – 7/1

8/ Oats are annuals that will temporarily stabilize an area and then be killed by a hard frost. Canada wild rye and side oats grama are short-lived native perennial grasses.

Runoff Control

Runoff from impervious surfaces and roof gutter downspouts should be directed to maximize infiltration. Runoff should be maintained in sheet flow (not channels) to the greatest extent possible. In soils where adequate infiltration cannot be achieved, outletting through a tile may be an option.

Wave Control

In areas where waves may influence the establishment of native vegetation products such as coconut fiber logs may be staked along the edge of open water to decrease wave energy. More elaborate wave break structures may be needed in some situations.

Fire Prevention

Areas with sandy soils are prone to forest fires. Conifer trees are especially susceptible to fire. To reduce fire danger, avoid planting conifers close to structures in those sandy areas of the state. Fire hazard is lower if conifers are planted on the waterward rather than the landward side of the house. Contact your local Department of Natural Resources for information about fire-prone areas.

Cost of Buffer Preparation

Costs for completing a shoreland habitat project vary greatly. Planting shrubs or trees as bare-root stock greatly saves on the cost. Costs are kept to a minimum when landowners do the work themselves. If contractors are used, costs generally increase, but an experienced contractor may save money in the long run because the project may be more successful. Costs increase as the

design shifts from "natural recovery" to "accelerated recovery." Seeding is generally cheaper than planting seedlings. However, seed takes longer to establish and there may be poor germination and seedling survival and excessive weed growth. Larger more established stock increases the price of the restoration. Balance budget constraints with concerns regarding timeliness and appearance.

Plant and Seed Sources

The DNR, counties, lake associations, and conservation groups sponsor shrub and tree sales annually in the spring. Statewide lists of native plant and seed sources are available from your local government offices.

Viewing and Access Corridor Design

Viewing corridors that are oriented somewhat obliquely to the shoreline, or are curved, are preferable to those that are perpendicular to the shoreline. This reduces the visual impact of human activities in the shoreland area. Corridor dimensions shall be determined by applicable local and county standards and ordinances; however, the recommended maximum width of the viewing and access corridor shall be 30 feet.

Steps for Accelerated Recovery

Proper site preparation is one of the most important steps in establishing a native plant landscape. Reducing competition on the site by first removing the existing non-native vegetation is especially important. Turf grasses can quickly out-compete newly planted native plants if left in place.

Sometimes removing existing vegetation is not necessary, and it is possible to plant among existing scattered native plants or to leave zones of vegetation intact. The moist zone near the water's edge often consists mostly of native plants because turf grasses are flooded out. Seeds and underground stems may quickly revegetate the area if allowed to grow. Selected native flowers, grasses, and shrubs can usually be planted among existing native vegetation to fill in bare spots or to add color and variety. Plant flowers and grasses in a manner that will allow them to spread over the entire area. Stands of invasive plants like reed canary grass or purple loosestrife should be removed from wet areas.

Site Preparation

Removing Undesirable Vegetation

Techniques to remove existing vegetation by smothering and/or applying herbicide are described below.

Smothering – Use Black Plastic

Black plastic spread over vegetation eliminates light and creates heat that kills existing plants. This method is suitable for almost any site. In areas with high exposure to wind, extra care must be taken to anchor the plastic in place.

1. You will need
    - 3.5 mil or thicker black plastic to adequately cover the area, plus extra to overlap sheets at least 6 inches.
    - 4 inch or longer, 11 gauge or heavier U-shaped metal staples (enough to space 1 foot apart where plastic overlaps and at the edges).
    - Heavy objects like logs, cement blocks, boards, or tires to hold the plastic in place.

2. Prepare the site by mowing, weed whacking, or trimming vegetation to be removed.

3. If soil is dry, water thoroughly. This will increase the weed killing effectiveness.

4. Lay down the plastic. Overlap the plastic at least 6 inches if using more than one piece. Staple in place at one-foot intervals as it is laid down.

5. Place heavy objects over plastic. All seams and edges must be firmly anchored to exclude light. Edges can also be buried in a shallow trench to help hold them in place.

6. Leave the plastic in place for 4-6 weeks during spring or summer. Make certain there is no sign of living vegetation before removing it.

7. Remove plastic, but leave dead vegetation in place. If using plant mulch over the dead vegetation, plant directly through the mulch.

Applying Herbicide

A glyphosate herbicide like Roundup® is recommended. Avoid drift of herbicide to water. If herbicide is to be applied in or over the water, an aquatic glyphosate formulation such as Rodeo® must be used, and a Department of Natural Resources permit is required. Always follow label instructions carefully.

Timing of herbicide applications is crucial. Do not apply when rain is forecast in the next 24 hours. Do not apply on windy days, since vegetation you wish to preserve may be damaged by herbicide drift. Vegetation must be actively growing for glyphosate herbicides to be effective. To encourage growth, mow grass and allow it to regrow several inches. Air temperature must be between 50 and 75 degrees Fahrenheit for cool season plants like quack grass and brome grass to be actively growing, and therefore effectively killed by the herbicide.

Be certain that vegetation is dead before planting. If turf is still green or yellow-green after 7 – 10 days, a repeated herbicide application is recommended.

Soil Amendments

In most cases soil amendments are not required to plant native plants. Adding black dirt or manure can be detrimental to lakeshore plantings. These soil amendments will favor weed growth, and the native plants may grow more quickly and be less sturdy.

Planting Techniques

Seedlings

On nutrient poor soils, fertilizer may be required where mulches are used because they demand nitrogen as they decompose. Fertilizer should never be broadcast due to the potential for runoff into the lake. Instead, apply a very small amount of slow release phosphorous free fertilizer in each planting hole. Phosphorus levels are adequate in most soils, and phosphorus can increase algae growth in the lake. Phosphorus is the middle number of the three given on the fertilizer bag.

Application amounts will vary depending on nutrient concentration. For a 6-0-6 NPK ratio, use one teaspoon of organic fertilizer per grass or wildflower plant and ¼ cup per shrub or tree. Up to one cup can be added to larger shrub or tree planting holes.

Dead vegetation left in place after smothering or an herbicide application does not need to be removed. Leave the dead material to serve as a mulch to capture moisture, reduce weed growth, and add organic material to the soil. Plant seedlings directly through the dead material. Roots must be buried in soil and not in the thatch of dead lawn, where the plant would quickly dry out and die.

Plants Installation

1. ***Lay mulch down prior to planting.*** Spread 2 to 3 inches of straw, wood chips, leaves, or pine needles to conserve moisture and reduce weed growth. Avoid using field hay because it generally contains weed seeds. Do not use marsh hay, which is reed canary grass, and is an invasive species.

2. ***Be ready to water***. Watering plant plugs is critical to their success. Be ready with hoses and sprinklers before planting. Water seedlings immediately after they are planted.

3. ***Dig holes for plants***. A bulb planter or bulb auger drill bit attached to an electric drill will work well to speed up planting. Be sure the holes for the plants penetrate the dead grass.

4. ***Fertilize***. A small amount of slow release, phosphorus-free fertilizer is recommended. The second number on the fertilizer label represents phosphorus. To fertilize, place a small amount in each plant hole. Excess fertilizer will encourage weed growth.

5. ***Place live plants in the ground soon after they are brought to the site.*** To store plants for a few days before planting, keep them in an area with partial sun such as on the east side of a building or under a deciduous tree. Do not leave them in a dark area for long periods; this will weaken plants. Water to keep packs moist once or twice a day.

6. ***Plant in the cool hours of the day***. Plants will have a greater survival rate if planted on a cool day or during the morning or evening hours. To plant, separate the mulch, dig a hole, sprinkle organic fertilizer, place the plug in the hole, press the soil gently around the plug, and replace the mulch, being careful to keep mulch 1/2" from stem of plants.

7. ***Water.*** Water immediately after planting. Plan to water at least daily for the first few weeks or until plants are well established. If plants wilt or droop, a repeated watering may be necessary during the day. Once plants are established, water only if prolonged dry periods occur.

Seed Installation

1. ***Rake or till only enough to expose soil for planting seed***, no more than 1–2 inches deep.

2. ***Select seed***. Refer to Table 1 for seeding densities. Greater amounts of seed will result in denser growth and better chances for success. Include 1 ounce of Canada wild rye per 1,000 square feet if desired. This seed will germinate readily to indicate areas where seeding is successful and help to hold the soil in place. Canada wild rye is a short-lived native perennial grass.

3. ***Mix seeds with slightly moist sand or sawdust.*** Fill an ice cream pail or similar one gallon bucket 2/3 full with moist, but not wet, sand or sawdust. Add up to 4 ounces of seed and mix well. The seeds will adhere to the sand or sawdust, so they can be spread more thinly and evenly.

4. ***Broadcast the seed/sand mixture.*** Use half of the seed/sand mixture to cover the entire area. Sow the remaining half while walking perpendicular to the line of the first pass to assure good seed distribution. The sand or sawdust will make it easier to see places that have not been seeded.

5. ***Press seed in by tamping down the soil*** with a rake or lightly raking the seeds in. The site may be rolled with a water-filled roller to insure good soil/seed contact. Do not roll when soil is wet, this will compact the soil, decrease levels of oxygen in the soil, and reduce seed germination.

6. ***Mulch lightly with 1/2 inch of weed free straw*.** Soil must be visible between the straw stems, or the mulch is too thick to allow seedlings to grow. If mulch is used on steep slopes, hold it in place with jute or biodegradable net. A biodegradable erosion control blanket up to ½ inch thick may be used as an alternative to mulch.

7. ***Water.*** Water immediately following seeding. Watering seeds and small seedlings after sprouting is critical for sandy soils. Plan to water daily, preferably in the morning, for the first few weeks or until plants are well established. Check to see that soil is moist beneath the mulch. Very sandy sites may require watering more than once daily for the first few weeks. Once plants are established, water only if prolonged dry periods occur.
   Note: Watering may not be necessary for spring plantings in areas with loamy or clay soils as long as regular (weekly) rainfall of ½ inch or more occurs.

Shrubs and Trees

1. ***Keep bare-root stock moist and cool before planting*.** Dormant bare-root shrubs can be ordered in fall or winter for delivery in the spring. Plant bare-root stock as soon as it arrives if possible. If necessary, store bare-root stock close to 34 degrees Fahrenheit, to avoid breaking dormancy. Keep tree roots moist by periodically sprinkling with water. Do not soak roots in water because this will deprive them of oxygen.

2. ***Dig the hole deeply enough so that the roots won't curl or bunch up.*** The trees and shrubs should be planted with the root collar at the soil line or no more than ½" deep. Paler colored bark and a slight swelling on the stem show where the old soil line was. Bare rootstock may need to be root pruned.

3. ***Pack soil firmly around the roots.*** Air pockets left around the roots will dry them out. Press soil around the roots with your foot, but do not stomp on them.

4. ***Water regularly*** to keep soil moist but not saturated.

5. ***Mulch*** a two-foot diameter circle around each plant 4 to 5 inches deep with wood chips, straw, or leaves. Keep mulch away from the bark. This will reduce competition with other plants. Keep this area free of other growth by weed whacking or hand-pulling weeds for the first couple of years. Avoid mulching where there are steep slopes. In this case, reduce competition by weed whacking.

Transplanting Trees and Shrubs

It is best to transplant when trees and shrubs are dormant in the early spring or late fall. Identify and label trees and shrubs when leaves are on the plant. Obtain permission from the landowner before removing plant material. Dig up as much of the root as possible. Replace the duff layer of leaves and stems to reduce erosion at the site. Only dig up trees and shrubs if they are part of a large stand or if the seedlings are numerous. If the tree or shrub is uncommon or rare, do not move it. Only remove a small percentage of any one type of plant. Leave behind a large enough population to allow further reproduction of the native population.

Site Care and Maintenance

The most ideal maintenance is to simply leave the site alone. Do not fertilize, do not mow, do not rake, do not "clean up" fallen limbs or trees. Allow native vegetation to regrow.

In accelerated recovery areas, some initial maintenance may be required. Pulling invasive weeds around native shrubs, trees, and groundcovers the first year or two eliminates competition and will help to give them a good start. Maintenance over the long-term must be in accordance with the local shoreland ordinance requirements.

The duff layer, made up of fallen leaves and pine needles, should be left intact. This layer covers the soil, thereby conserving moisture, preventing erosion, and allowing water to infiltrate into the soil.

Year One

Watering

Regular watering in the first two months of a spring or summer planting is one of the most important factors for success. Without supplemental watering, roots may not reach the soil moisture they need. Watering at least 30 minutes each day or 1" per week including rainfall allows vigorous root growth for plants to become quickly established. Timers to turn water on and off automatically are available from hardware and garden supply stores.

Where drainage is poor, water only in the morning, not at night when evaporation is reduced. Fungal diseases that start with excess moisture can kill young seedlings. Use lake water if feasible, since this water often is warmer and more nutrient-rich than well water. Pumping water from the lake may require a permit from the MDNR..

Protection Against Deer Browsing

Whitetail deer and other animals may damage plantings, especially trees and shrubs. Protect against damage by physical or chemical means. Surround newly planted trees and shrubs with 4 – 6 foot high, galvanized mesh fence supported with wooden stakes or fence posts, or cover plants with bird netting. Landscape products available to spray on plants deter browsing through strong tastes or odors. Red pepper spray is an example. Use of these products may need to be varied as deer become accustomed to their taste or smell. Protection against deer browsing is particularly important if deer are fed on the site or nearby. Deer feeding should be discouraged near restoration areas.

Weeding Planted Areas
Pull weeds out as early as possible being careful to not disturb the native plants. Be especially diligent in areas where non-native invasive species like purple loosestrife, mullein, lamb's quarter, quack grass, reed canary grass or bluegrass are known to be present.

Weeding Seeded Areas
It can be difficult to tell weeds from the native plants in a seeded area. Sprouting a small sample of the native seeds in a plant tray will assist with their identification. Cut off flowering heads of weeds before they go to seed. Perennial natives will eventually out-compete annual weeds that sprout from seed.

Another alternative is to repeatedly trim weedy vegetation to 6 to 8 inches with a weed-whacker. Remove clippings immediately if they cover the native seedlings. This will discourage weed growth, remove shade, and allow native seedlings to grow.

Fertilizing And Applying Insecticides
Fertilizers and insecticides should be avoided. Applying fertilizers may encourage weed growth. If native plants are selected appropriately, supplemental fertilization should not be required. Also avoid applying insecticides since so many are non-specific and can harm or even kill non-target species.

Vegetative Cover
At the end of the growing season, allow all dead vegetation to remain in place. It becomes a valuable seed source for next year's growth, provides food and cover for wildlife, and will help to cover the soil and slow spring runoff. The grass seed and dried flower heads add another level of appeal to the native landscape in the winter months.

Year Two

Watering
Water only during periods of severe drought.

Weeding
Thoroughly weed early in the summer. After this initial weeding, check for and remove weeds at least once a month.

Year Three and Beyond

No watering or weeding should be necessary except for extreme drought conditions or stubborn invasive weed problems. Leave vegetation in place in the fall and through the winter months. Approval from the zoning or land conservation office is required for extensive weed removal in the shoreland zone.

Prairie and savanna areas may be trimmed or burned only under an approved management plan. Additional permits or approval may be necessary before trimming or burning. Trim groundcover in prairie areas no more than once every three to five years. Groundcover should be cut no less than 6-8 inches high. Cut vegetation in the late winter when the ground is still frozen, or in late spring, when the ground is dry enough to walk on without damaging new growth. Leave all dead plant clippings on-site. They will add to the shoreland soil structure. A controlled burn may be appropriate only in prairie and savanna areas. A burn should not be attempted until the prairie or savanna is well established – usually after five or more years. To determine if a controlled burn is appropriate evaluate the site for safety considerations; threats to structures, shrubs, and trees; and weed species present. In addition to any required permits, Department of Natural Resources broadcast burning permits are required in intensive fire zones.

Except in prairie areas that are identified in an approved management plan, any native trees, shrubs, and groundcover in the restoration area shall be left undisturbed. Trees and shrubs are intended to move in to create multiple layers of canopy cover. Tree thinning or removal of dead or diseased trees requires approval of the appropriate administering agency.

Vehicles shall be excluded from the buffer except for limited use in the viewing/access corridor. Docks and boatlifts shall be stored outside the buffer or in the viewing/access corridor.

Resources

References for Plant Selection

Please note that counties may have approved or recommended plant lists.

Dickerson, J, et. al. (1998) Vegetating with Native Grasses in Northeastern North America. Ducks Unlimited Canada.

Eggers, S.D., Reed, D.M. (1997) Wetland Plants and Plant Communities of Minnesota & Wisconsin. U.S. Army Corps of Engineers. St. Paul District.

Fassett, N.C. (1980) A Manual of Aquatic Plants. The University of Wisconsin Press.

Ladd and Oberle (1995) Tallgrass Prairie Wildflowers. Falcon Publishing Inc.

Preston, R.J. (1976) North American Trees. Iowa State University Press.

Shaw, D., Schmidt, R. (2003) Plants for Stormwater Design, Species Selection for the Upper Midwest. Minnesota Pollution Control Agency.

Snyder, L.C. Native Plants for Northern Gardens. Andersen Horticultural Library. University of Minnesota Libraries. Minnesota Landscape Arboretum.

United States Department of Agriculture, Natural Resources Conservation Service (species specific information) [http://www.plants.usda.gov/plants/index.html].

General Resources

Craven, S. and Hygnstrom, S. (1996) Controlling Deer Damage in Wisconsin (G3083). University of Wisconsin-Extension. Madison, WI. [http://www1.uwex.edu/ces/pubs/pdf/G3083.PDF].

Henderson, C., Dindorf, C. and Rozumalski, C. (1998) Lakescaping for Wildlife and Water Quality. Minnesota Department of Natural Resources, Section of Wildlife, Nongame Wildlife Program. St. Paul, MN. 176 pp.

MNDNR. Restore Your Shore. Restore Your Shore (RYS): Minnesota DNR

Shoreland Restoration: A Growing Solution, (A fifteen-minute video that provides instructions for planting native trees, shrubs, and seedlings) To obtain a copy call: 1-877-947-7827. Ask for GWQ032.

The Living Shore, (A seventeen-minute video about shoreline buffer zones) To obtain a copy call 1-800-876-8630. Ask for VH7129.

Petrides, G.A. (1972) A Field Guide to Trees and Shrubs. Houghton Mifflin Company.

Appendix One

Sample Shoreland Habitat Restoration SITE PLAN

Appendix one includes a completed shoreland habitat restoration site plan for an example site. The narrative component of the plan includes:

- Plant density calculations
- Narrative to accompany the restoration site diagram
- Preparation schedule
- Planting dates and schedule
- Care and handling of plant materials
- Maintenance plan
- Plant lists appropriate for the site

The site diagram component of the plan (Appendix Two) includes labeled drawings, not to scale, of (a) existing site conditions and (b) planned restoration components.

Sample Shoreland Habitat Restoration SITE PLAN

SHORELAND HABITAT RESTORATION SITE PLAN PREPARED FOR:

LANDOWNER NAME
SHORELAND ADDRESS
MAILING ADDRESS

Plan Components

This shoreland habitat restoration site plan, prepared for your property, contains several components:

- A site diagram of existing conditions. This diagram was used in calculating areas for restoration and developing the site plan.
- A site diagram of the proposed restoration for your property. This diagram identifies the areas to be restored, and the type of site preparation, planting and maintenance needed.
- Written information about your site plan and instructions for carrying out your site restoration.

Shoreland Habitat Restoration Standards

[Technician Note: In this section, you will give a brief description of the shoreland habitat restoration plan and its maintenance requirements.]

The minimum practice depth is 35 feet. Where the principal structure (home) is within 50 feet of the ordinary high water mark, land within 15 feet of the structure may be excluded from the practice. A single viewing/access corridor up to 30 feet wide may extend from the lake inland. Viewing corridors that are oriented somewhat obliquely to the shoreline, or are curved, are preferable to those that are perpendicular to the shoreline. This reduces the visual impact of human activities in the shoreland area.

Vegetation removal and land disturbing activities are prohibited in the restoration area. Mowing and limited pruning are allowed in the viewing/access corridor. Walkways, pathways, and stairs must be located in the viewing/access corridor; and piers, wharfs, and lifts must be placed in water immediately in front of the corridor.

Plant Density Calculations

[Technician Note: Provide the calculations for plant densities.]

Total restoration area: 3500 ft2 (above ordinary high water mark). See the attached site map. Worksheets 1and 2 below show the calculations for the numbers of plants that are needed for this site.

Worksheet 1: Area Calculations							
	Total Area of Shoreline (Square Feet)		**Total Area of Viewing/Access Corridor**		**Total Area of Existing Layer to Preserve and/or Natural Recovery Zones**		**Total Area to be Planted**
Tree Layer	3500	-	1050	-	925	=	1525
Shrub Layer	3500	-	1050	-	700	=	1750
Herbaceous Layer Plants	3500	-	1050	-	1450	=	1000
Herbaceous Layer Seeds	N/A	-	N/A	-	N/A	=	N/A

Worksheet 2: Seed or Plant Densities							
	Total Area to be Planted (Square Feet)		**Density Factor**		**Seed or Plant Densities From Table 1**		**Total Plants or Seeds to Install**
Tree Layer	1525	÷	100	x	0.1	=	2
Shrub Layer	1750	÷	100	x	0.25	=	4
Herbaceous Layer Plants	1000	÷	100	x	100	=	1000
Herbaceous Layer Grass Seeds	N/A	÷	1000	x	N/A	=	N/A
Herbaceous Layer Forb Seeds	N/A	÷	1000	x	N/A	=	N/A

Shoreland Habitat Restoration Site Diagram

[Technician Note: In this section, describe the different components of the shoreland habitat restoration plan. The technician should include appropriate plant lists on the back of the restoration site diagram.]

The attached Shoreland Revegetation Plan/Site Diagram provides guidance for planting your restoration. Plant selections are found on the reverse of the plan drawing. Vegetation that is native to [Sample] County has been selected for soil moisture and light conditions on the site. Substitutions may be made from the attached plant lists.

Site Diagram Specifications

[Technician Note: Describe the different areas located on the site plan.]

Natural Recovery Zone (Wet Mesic Prairie)

Allow existing vegetation to grow in this area. You may wish to plant some wet mesic prairie wildflowers or grasses to add color and diversity.

Accelerated Recovery Zone (Oak Savanna/Dry Mesic Prairie)

It will be necessary to eliminate the turf grasses to lessen competition for the newly planted native plants. Prepare area “21” by spraying with herbicide or smothering with black plastic to kill existing vegetation. Plant prairie flowers and grasses from the Oak Savanna/Dry Mesic Prairie list. Plant flowers and grasses in a manner that will allow them to spread over the entire area.

In area “22”, turf grasses were never fully established. Plant native trees and shrubs and allow native grasses and wildflower plants to regrow. Additional plants from the Oak Savanna/Dry Mesic Prairie list may be added as needed.

Viewing/Access Corridor

A 30-foot wide viewing/access corridor is permitted for this practice. Within the viewing/access corridor, there is a stairway to the lake and a fire pit area. **This area may remain in turf, and the fire pit may be left in place.**

Preparation Schedule

[Technician Note: Provide approximate dates for completion of restoration plan elements.]

Table 4. Preparation Schedule		
Remove existing vegetation in prairie area:	Plastic	2 months before planting
	Herbicide	3 weeks before planting
Order plants	Winter/early spring before planting	
Gather supplies	2 weeks before planting	

Planting Dates and Schedule

Table 5. Planting Dates and Schedules		
Prairie	May 20th – September 15th	
Shrubs and Trees	Bare Root	Before leaf out or after leaves fall
	Potted	Any time soil is not frozen

Plant Materials

[Technician Note: Describe how property owners should obtain, store, and install plant materials.]

Obtaining Plants

[Technician Note: The technician should supply the options for plant procurement in this section.]

Prices and plant availability vary. The [Sample] County Conservation Department sells appropriate plant mixes in a spring (early June) native plant sale. Plugs of 48 seedlings are available for under $25 each. Orders are taken beginning in January.

Storing Plant Materials

Follow suppliers instructions. Use plugs/seedlings as soon as possible. To hold plants or potted shrubs, store them in an area with partial sun such as on the east side of a building or under a deciduous tree. Do not leave them in a dark area for long periods; this will weaken plants. Water to keep packs moist once or twice a day.

Plant bare root stock as soon as it arrives if possible. Store bare root stock at about 34 degrees F to avoid breaking dormancy. Keep tree roots moist by periodically sprinkling with water. Do not soak roots in water because this will deprive them of oxygen.

Planting Instructions

[Technician Note: The technician should provide planting information specific to site and plant materials chosen.]

Includes information you and/or your landscaper will need to prepare your site and complete your planting. Plant lists suitable for your site are also included in this section.

Site Care and Maintenance

[Technician Note: Provide instructions on the maintenance of the shoreland habitat restoration. Address site specific concerns as appropriate.]

It is critical that timely care be given to ensure plant materials are adequately established. Once the site is adequately established, keep the following guidelines in mind: Do not fertilize, do not mow (except on a spot basis to control competing weeds), do not rake, do not "clean up" fallen limbs or trees. Allow native vegetation to regrow. The duff layer, made up of fallen leaves and pine needles, should be left intact. This layer covers the soil, thereby conserving moisture, preventing erosion, and allowing water to soak into the soil. Plants lost due to desiccation, deer browsing or for any other reason must be replaced. Guidelines for caring for your restoration during establishment are given below.

Year One

Watering
Regular watering in the first two months of a spring or summer planting is one of the most important factors for success. Without supplemental watering, roots may not reach the soil moisture they need. Watering at least 30 minutes each day allows vigorous root growth for plants to become quickly established. Timers to turn water on and off automatically are available from hardware and garden supply stores. Use lake water if feasible, since this water often is warmer and more nutrient-rich than well water. Pumping water from the lake may require a permit, contact your local MDNR water management specialist if you have any concerns or questions.

Protection Against Deer Browsing
Whitetail deer and other animals may damage plantings, especially shrubs. Protect against damage by physical or chemical means. Surround newly planted shrubs and trees with 4 – 6 foot high, galvanized mesh fence supported with wooden stakes or fence posts, or cover plants with bird netting. Landscape products available to spray on plants deter browsing through strong tastes or odors. Red pepper spray is an example. Use of these products may need to be varied as deer become accustomed to their taste or smell. Protection against deer browsing is particularly important if deer are fed on the site or nearby. Deer feeding should be discouraged near restoration areas.

Weeding
Check for weeds once every two weeks. Pull weeds out as early as possible being careful to not disturb the native plants. Do not allow invasive species like purple loosestrife, mullein, lamb's quarter, quack grass, reed canary grass, bluegrass, and others to take over the planting.

Fertilizing And Applying Pesticides
The use of fertilizers and pesticides is prohibited. Applying fertilizers may encourage weed growth. If native plants are selected appropriately, supplemental fertilization should not be required. Also avoid applying pesticides since so many are non-specific and can harm or even kill non-target species.

Vegetative Cover
At the end of the growing season, allow all dead vegetation to remain in place. It becomes a valuable seed source for next year's growth, provides food and cover for wildlife, and will help to cover the soil and slow spring runoff. The grass seed and dried flower heads add another level of appeal to the native landscape in the winter months.

Year Two

Continue maintenance practices for year one except as noted below.

Watering
Water should only be needed during periods of severe drought.

Weeding
Thoroughly weed early in the summer. After this initial weeding, check for and remove weeds at least once a month.

Year Three and Beyond

No watering or weeding should be necessary except for extreme drought conditions or stubborn invasive weed problems. Leave vegetation in place in the fall and through the winter months. Tree thinning or removal of dead or diseased trees requires special approval from the [insert name of administering agency].

Prairie and savanna areas may be trimmed only under an approved management plan. Trim groundcover in prairie areas no more than once every three to five years. Groundcover should be cut no less than 6-8 inches high. Cut vegetation in the late winter when the ground is still frozen, or in late spring, when the ground is dry enough to walk on without damaging new growth. Leave dead plant clippings on-site. They will add to the shoreland soil structure.

Except in prairie areas that are identified in an approved management plan, any native trees, shrubs, and groundcover in the restoration area should be left undisturbed. Trees and shrubs are intended to move in to create multiple layers of canopy cover. Collection of seeds for use outside of the practice area is prohibited until the planting has been in place for at least three years.

Vehicles should be excluded from the restoration area except for limited use in the viewing/access corridor. Docks and boatlifts should be stored outside the restoration area or in the viewing/access corridor, if possible.

Plant Lists

[Technician Note: Supply a list of native plant materials to be used in the shoreland habitat restoration. Select plant species based on appropriate plant communities for the region, as well as site conditions. Make certain the list is extensive enough to provide substitutions for species and meet specific program requirements for diversity].

Oak Savanna/Dry Mesic Prairie

Select a minimum of three grass species and five forb species from the list below.

Dry to medium soils Full sun 8 hours

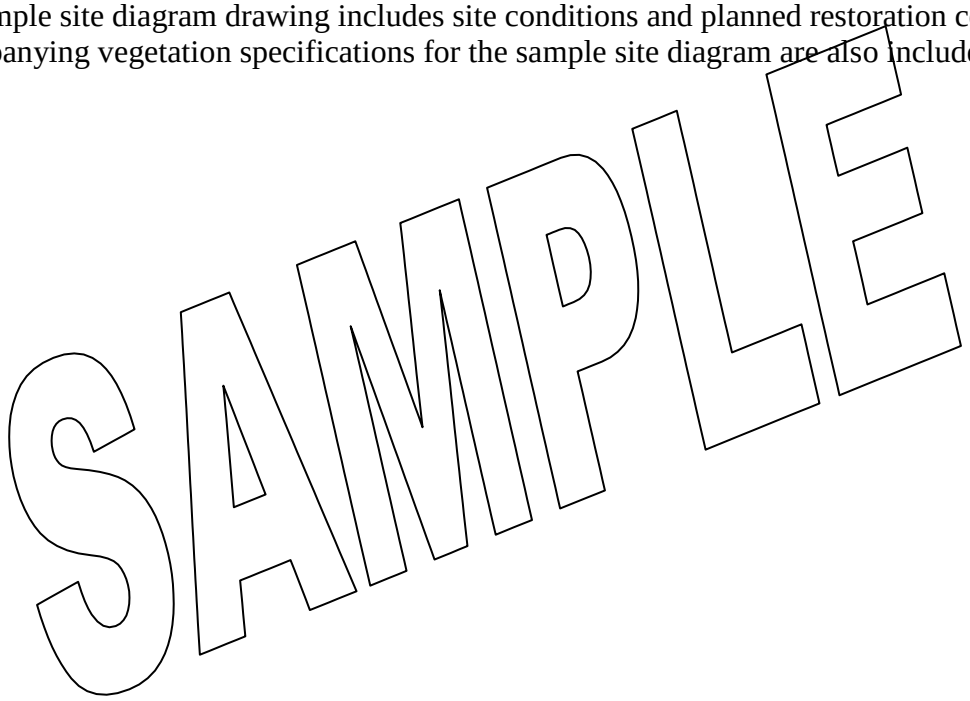
COMMON NAME	SCIENTIFIC NAME	HEIGHT	FLOWER COLOR
Grasses			
Big bluestem	Andropogon gerardii	3-8’	NA
Blue grama*	Bouteloua gracilis	1-2’	NA
Bottlebrush grass	Elymus hystrix	3’	NA
Canada wild rye	Elymus canadensis	3-6’	NA
Indian grass	Sorgastrum nutans	3-8’	NA
June grass*	Koeleria macrantha	1-2’	NA
Little bluestem*	Schizachyrium scorparium	2-3’	NA
Needle grass*	Stipa spartea	3-4’	NA
Prairie dropseed*	Sporobolus heterolepsis	2-4’	NA
Side oats grama*	Bouteloua curtipendula	2-3’	NA
Forbs			
Anise hyssop*	Agastache foeniculum	2-4’	Lavender
Bergamot*	Monarda fistulosa	2-4’	Lavender
Black-eyed Susan*	Rudbeckia hirta	1-3’	Yellow
Bush clover*	Lespedeza capitata	3-4’	Green
Butterfly weed*	Asclepias tuberosa	2-3’	Orange
Canada milkvetch	Astragalus canadensis	2-3’	White
Common oxeye daisy*	Heliopsis helianthoides	2-5’	Yellow
Dotted mint	Monarda punctata	1-3’	Lavender
Fireweed*	Epilobium angustifolium	2-6’	Pink
Frost aster	Aster epilosus	1-3’	White
Harebell*	Campanula rotundifolia	4-20"	Purple
Golden alexander	Zizia aptera	1-3’	Yellow
Hoary vervain*	Verbena stricta	2-3’	Blue
Lance-leaf coreopsis*	Coreopsis lanceolata	2-3’	Yellow
* = Best for driest sites NA = Not Applicable, no flowers or inconspicuous flowers			

Appendix Two

Shoreland Habitat Plan Site Diagram Job Sheet

Appendix two includes a blank Shoreland Habitat Plan Site Diagram Job Sheet followed by a sample intended for guidance. Ordinarily this job sheet would be provided on a double-sided 11 ½ X 17 size of paper, but for the purposes of this technical note publication, the following four pages represent the sample site diagram job sheet as can be viewed on 8 ½ X 11 size paper front and back.

The sample site diagram drawing includes site conditions and planned restoration components. The accompanying vegetation specifications for the sample site diagram are also included.



Shoreland Habitat Restoration Plan Legend		What To Include in Your Plan
	Property Line	• Boundary of the buffer
	Ordinary High Water Mark	• Location of ordinary high water mark
	Viewing Corridor/Access	• Location of the Viewing/Access corridor
XXXXXXXXXXX	No Touch Boundary	• Location of shrubs and trees to be planted
	Existing Channel Drainage	• Areas where native ground will be planted
	Existing Trees	• Erosion control practices to be installed during buffer establishment
	Existing Shrubs	• Practices to eliminate channel flow in the buffer
	Existing Ground Cover	• Source of water for watering
	Existing Structures	• Location of existing primary structures within the buffer
	New Trees (Corresponds to Plant List #)	
	New Shrubs (Corresponds to Plant List #)	
21	New Ground Cover (Corresponds to Plant List #)	

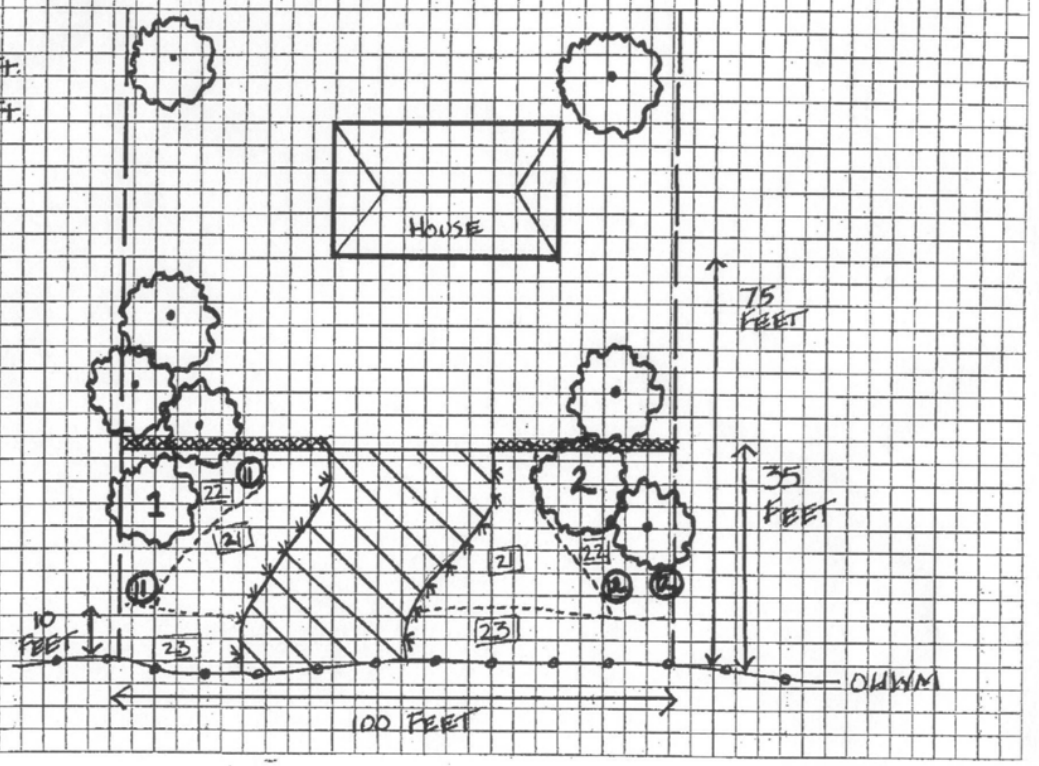
Buffer Restoration Plan - Site Diagram

Use the directions and symbols found on the back of this page to complete the diagram

Scale: 1 INCH = 20 FEET

Please indicate north by drawing an arrow. N ↑

TOTAL AREA OF RESTORATION = 35' x 100' = 3500 sq. ft.
VIEW CORRIDOR = 35' x 30' = 1050 sq. ft.
ACCELERATED RECOVERY AREAS
[21] = 450 sq.ft + 550 sq.ft. = 1000 sq. ft.
[22] = 310 sq.ft + 440 sq.ft. = 750 sq.ft.
NATURAL RECOVERY AREA
[23] = 10' x 70' = 700 sq. ft.



Project Location (Include Fire #, Road Name and Lake)

Landscaper _____ Phone Number _____

Worksheet Completed By _____

Owner _____ Phone Number _____

Date _____

Plan Approved By: _____
Date: _____

NOT TO SCALE