APPENDIX E – VEGETATIVE EROSION CONTROL GUIDELINES FOR NATURAL RESOURCE MANAGEMENT

Introduction

The purpose of this document is to provide information to facilitate the successful and timely re-establishment of vegetation following earth change activities. In most situations, vegetation is the best means of controlling wind or water erosion and preventing sediment transport and off-site sedimentation.

This document focuses on methods for the quick establishment of vegetative ground cover and establishing permanent native vegetative ground cover. It also discusses what environmental regulations apply regarding establishing vegetative cover for erosion control.

With respect to erosion control, the key legislation (and its administrative rules) that applies here is Part 91, Soil Erosion and Sedimentation Control (SESC), of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). As discussed in the manual, *"Sustainable Soil and Water Quality Practices on Forest Land"*, Part 91 applies whenever there is an "earth change" (e.g. removal of the vegetative cover and soil disturbance by a bulldozer) that is one or more acres in size or within 500 feet of a water body. Refer to the manual's section 2, "Laws and Permits" and Appendix C – "List of Applicable Laws in Michigan", for more information regarding Part 91 and its requirements.

Natural revegetation of areas in which the vegetative ground cover has been removed rarely occurs with the rapidity or vigor required to prevent erosion. Consequently, methods that quickly re-establish vegetative ground cover are required. Seeding using grass species is the most commonly used and most effective means of re-establishing vegetation.

For erosion control, many governmental agencies and landowners have relied heavily on using certain non-native and invasive plant grass species. However, increasingly it is being recognized that these species can cause ecological damage. Alternatives are being sought to control erosion using grass species native to the region and state. An additional consideration is to use native plant species seed of a locally adapted genotype (seed from local populations of native species) as locally adapted genotypes often grow better in the long term.

Definitions That Apply To This Document

Native plants are naturally occurring species that existed in Michigan prior to European settlement.

Native plant genotypes are represented by genetic strains that have evolved in Michigan and are assumed to be adapted to Michigan's conditions.

Non-native species are species that were not naturally occurring in Michigan prior to European settlement. Some of these plants have had little impact on native species, others have had direct negative impacts on native species.

Invasive non-native plants are species that have had direct negative impact on our state's natural resources. These plants are very aggressive and out compete native plants. Examples include autumn olive and purple loosestrife.

Native and Introduced Species

Within the natural resource management field, as well as the general public, there is increasing concern regarding current and potential future damage to native ecosystems due to the establishment and spread of certain non-native plant species (e.g., garlic mustard, purple loosestrife, crownvetch). These non-native species are referred to as "invasive" as they disrupt native ecosystems that maintain or conserve native plant and animal biodiversity.

Many non-native grasses and other plant species introduced in the past and promoted for erosion control have proved to be less beneficial for their intended purpose than native species. Some of these introduced species have become invasive or noxious. However, many non-native plant species, such as those used for erosion control, are economical and readily available relative to native plant species.

Native species can be expensive and only available from a limited number of suppliers. Despite these factors, forest land managers and others are realizing long-term ecological and economic benefits by re-establishing locally adapted genotypes of native vegetation for erosion control and other restoration efforts.

In Michigan, the Michigan Department of Natural Resources (MDNR) and federal land management agencies emphasize or, in some cases, require the use of native species vegetation, and, if available, locally adapted genotypes on the lands they manage. The MDNR encourages the use of native seed or native vegetation on private lands as well.

To meet legal requirements and prevent soil from eroding into a water body, certain introduced species may be used, especially if quick establishment of vegetative cover is needed. However, this document only recommends those non-native species that are not considered to be invasive, which are most likely to promote the natural succession of the site to native ground cover or are not likely to interfere with the native seed applied at a later date.

Planning and Site Assessment

Proper planning and site assessment is essential to insure erosion control and establishment of native ground cover. The selection of plant species to use and establishment procedures should match the plant's adaptations to local site conditions, including:

- available sunlight
- slope
- topography
- local climate
- soil drainage class
- soil texture
- proximity to environmentally-sensitive areas or natural plant communities
- soil fertility
- soil pH

To ensure proper establishment, a soil test may need to be taken at the site and soil amendments (e.g., fertilizer and lime) may need to be applied. In many cases, soil amendments will not be necessary when using suitable native plants. Managers should plan to stockpile the topsoil that was removed from the site during road and landing construction, to later use when topsoil is needed for the re-establishment of vegetative ground cover.

Site Preparation

The purpose of site preparation is to have good contact between soil and seed to achieve acceptable levels of germination. For temporary roads, landings and primary skid trails, site preparation generally occurs after harvest operations have been completed. Where disturbed/bare soil sites are small and soil compaction is minimal, it may be suitable to use a hand rake to prepare the seedbed (e.g., secondary skid trails in a Riparian Management Zone (RMZ) on dry, upland or non-saturated soils).

Topsoil Use

It is essential for successful and quick revegetation to have a suitable depth of firm, but friable topsoil. Part 91 erosion control guidelines state that disturbed sites have a minimum of 3 to 4 inches of firm, but friable topsoil. However, these same guidelines allow for professional judgment and knowledge as to what depth of native topsoil will work as a suitable seedbed. Stockpiled topsoil that was removed from the site during road or landing construction should be re-applied when the constructed roads and landings are no longer required for operational or other forest management purposes (e.g. access to replant tree seedlings after a clearcut has occurred).

On sloped areas, prior to re-application of topsoil, roughen the subsoil to prevent a shear or smooth surface and slippage of the topsoil. Typically, surface roughening is accomplished by running tracked equipment (e.g. bulldozer) up and down the sloped area. If more topsoil is required to provide suitable seedbed germination, acquire topsoil from a source native to the area. Use topsoil that is not contaminated with non-native, weedy and invasive species.

Part 91 administrative rules state that a person shall complete permanent soil erosion control measures for all disturbed land areas within 5 calendar days after final grading or the final earth change has been completed. However, when seedbed preparation and/or seeding must be delayed due to weather, climate, seasonal conditions or certain resource management issues (pertinent to the site), then *appropriate* temporary erosion control (e.g. mulch) and sedimentation control measures (e.g. silt fence) shall be installed and maintained until seedbed preparation and seeding can commence.

Seeding and Erosion Control– Native and "Safe" Non-Native Species Use

Seed may be applied by hand, mechanical spreader, seed drill, or by hydro-seeding. Some native species must be applied with a drill.

Two objectives should be considered when seeding:

1) What is required to meet Part 91 requirements (quick establishment of vegetative cover and minimal erosion and sedimentation).
2) Long-term establishment of native vegetation.

To meet both of these objectives usually requires, at a minimum, the application of grass seed that is fast growing and provides fairly quick erosion control. As with other BMPs, there are a number of options based on the conditions of the site and when the seed is applied.

Seeding Recommendations

Seed Rates

All seeding rates, such as those stated in Table 2, are in pounds of "pure live seed" (PLS). In the case of certain native species, this can be significantly more than the weight of bulk seed.

When accounting for the amount of PLS, one will need to purchase and use more bulk seed than the weight per acre recommendations given for a particular seed species. Use the following formula to derive the required weight of bulk seed from the PLS rate. Germination, hard seed (a characteristic of legume seeds), and purity percentages are found on the information label attached to all commercially purchased seed.

$$\text{Pounds (lbs) of Bulk Seed} = \frac{\text{lbs PLS}}{(\text{purity}^* + \text{hard seed}^*)\,(\text{germination}^*)}$$

*express % purity, hard seed, and germination in hundredths; i.e. 97% = 0.97

For example, a seed label indicates Canada Wild Rye that has a germination rate of 90 percent, no hard seed content, and a purity of 97 percent. The "Cool Season" seed mix from Table 2 requires 4 pounds of Canada Wild Rye PLS/acre. Compute the bulk seed rate as follows:

$$\text{lbs of bulk Canada Wild Rye seed} = \frac{4}{(0.97+0)\,(0.90)} = \frac{4}{0.873}$$

lbs of bulk Canada Wild Rye seed = 4.6 (which is the equivalent of 4 lbs of PLS)

Table 1 provides a list of native and non-native ground cover species (grasses and forbs) to consider for erosion control. Table 1 provides, by plant species, the soil texture, soil moisture, and sunlight requirements for successful germination and establishment. The comments portion contains information as to whether a species is native or non-native, perennial or annual, and (for grasses only) if it is considered a warm season or cool season grass.

Key for Information in Tables 1 and 2:			
SOIL	**MOISTURE**	**LIGHT**	**REGION**
S - Sand	D - Dry	S - Full Sun	UP-Upper Peninsula
L - Loam	M - Moist	P – Partial Shade	NLP-Northern Lower Peninsula
C - Clay	W - Wet	Sh – Shade	SLP -Southern Lower Peninsula
M - Muck			SW - Statewide

Table 1. Native And Non-Native Plant Species To Use For Erosion Control In Forest Land

SPECIES NAMES Common (*Latin)*	**SOIL**	**MOISTURE**	**LIGHT**	**REGION**	**Comments**
Grasses:					
American beach grass (*Ampophila breviligulata*)	S	D	S	SW	Native perennial, dune stabilization – use plugs, not seed
Annual rye (*Lolium multiflorum*)	S-L-C	D-M-W	S, P, Sh	SW	Non-native annual, temporary cover

SPECIES NAMES Common (*Latin)*	SOIL	MOISTURE	LIGHT	REGION	Comments
Big bluestem (*Andropogan gerardii*)	S-L-C	D-M-W	S	SW	Native perennial, warm season grass*
Creeping red fescue (*Festuca rubra*)	S-L-C	D-M-W	S , P	SW	Non-native perennial
Indian grass (*Sorghastrum nutans)*	S-L-C	D-M-W	S-P	NLP, SLP	Native perennial, warm season grass*
June grass (*Koelaria micrantha*)	S-L-C	D-M	S, P	SW	Native perennial, cool season grass**
Little bluestem (*Schizachyrium scoparius*)	S-L	D-M	S, P	SW	Native perennial, warm season grass*, dune stabilization
Oats *(Avena sativa*)	S-L-C	D-M	S, P	SW	Non-native annual, temporary cover
Redtop (*Agrostis gigantea*)	L, C, M	M-W	S	SW	Non-native perennial, cool season grass**
Switchgrass (*Panicum virgatum*)	S-L-C	D-W	S	SW	Native perennial, warm season grass*
Wild-rye, Canada (*Elymus canadensis*)	S-L	D-M-W	S, P, Sh	SW	Native perennial, cool season grass**
Wild-rye, Virginia (*Elymus virginicus*)	L-C	M-W	S, P, Sh	SW	Native perennial, cool season grass**
Forbs (Wildflowers)					
Legumes:					
Alsike Clover (*Trifolium hybridum*)	L-M	D-M-W	S, P	SW	Non-native, perennial, good for forest roads in northern hardwoods
Lupine (*Lupinus perennis*)	S-L	D-M	S - P	SLP + Newaygo Co.	Native perennial, butterfly host, nectar source
Medium Red Clover (*Trifolium pratense*)	S-L-C	D-M-W	S, P	SW	Non-native, perennial legume, good for forest roads in northern hardwoods
Round-headed bush clover (*Lespedeza capitata*)	S-L	D-M	S	SLP + Newaygo Co.	Native perennial legume, wildlife food
White Dutch Clover (*Trifolium repens*)	L-C-M	D-M-W	S, P	SW	Non-native, perennial legume, good for forest roads in northern hardwoods
Other Wildflowers:					
Black-eyed Susan (*Rudbeckia hirta*)	L-C	D-M	S-P	SW	Showy native perennial, yellow
Butterflyweed (*Asclepias tuberosa*)	S-L	D-M	S	SW	Showy native perennial, orange
Common milkweed (*Asclepias syriaca*)	S-L	D-M	S-P	SW	Native perennial, pink, butterfly food
Horsemint (*Monarda punctata*)	S-L	D-M	S	SW	Native perennial, white/pink
Lance-leaved coreopsis (*Coreopsis lanceolata*)	S-L-C	D-M	S.P	SW	Showy native perennial, yellow

SPECIES NAMES Common (*Latin)*	SOIL	MOISTURE	LIGHT	REGION	Comments
Starry false solomon-seal (*Smilacina stellata*)	S	D-M	S-P	SW	Native perennial, dune stabilization, white
Wild Bergamot (*Monarda fistulosa*)	S-L-C	D-M	S	SW	Showy native perennial, pink
* Warm season grasses = most of their growing occurs during the warm summer months, July, Aug, Sept. ** Cool season grasses= most of their growing occurs in cool, spring months, May, June					

Table 2. Two Examples of Seed Mixtures Using Native Plants

Mix type	Common Name	Rate. lbs/acre
Cool Season	Canada Wild-rye	4
	Wild Virginia-rye	5
	Annual rye	5
Warm Season	Big Bluestem	4
	Indian grass	3
	Switchgrass	1
Note: For the Upper Peninsula, substitute Little Bluestem for Indian Grass		

Other Items to Consider When Planting Native Species in a Forested Setting:

While Part 91 erosion control guidelines can contain helpful information, they were developed with the primary purpose of establishing grass cover on construction sites after final grading has been completed. The next paragraph provides a few additional considerations specifically designed for natural resource management purposes. For more specific technical information as to the proper timing, soils and general methods to insure long-term establishment of a native plant seeding, contact the firm from which you purchased the seed.

As with introduced grasses, native grass/wildflower seed germination success requires good seed contact with soil. Depending on the site conditions, prepare the soil as needed and either handsow or use a prairie drill such as the Tye drill, Truax drill, or the John Deere Rangeland drill. If handsowing, it is advisable to mix the seed with a contact mulch such as wetted sand or vermiculite. If handsowed, rake or drag the seed in so that it is lightly covered with soil. Roll the site with a roller or drive over it to firm seed into the soil. Do not roll the site if the soil is wet so as to avoid soil compaction. Hydro-seeding is generally not recommended for wildflower and prairie grass seeding, as it does not ensure firm seed-to-soil contact.

Mulch Use after Seed Application

In some cases, applying the detritus from the forest floor may be considered if erosion is not an immediate threat, the site is not near a water body and conditions are right for seed within the detritus to establish.

In most situations, it will be appropriate to apply a light covering of clean, weed-free straw with some moisture content, as this will increase germination rates. This is particularly helpful on dry

sandy soils and heavy clay soils. Straw should just cover the soil surface, but not bury it. Some soil should be visible through the straw. Chopping and blowing the straw onto the area is the best method, as chopped straw is less susceptible to being blown away by the wind. On steep slopes, hold the straw in place by using biodegradable stakes and mesh over the straw. Never use field hay, as it invariably contains innumerable weed seeds.

Conclusion

These guidelines are just that, guidelines as of early 2007. Introduced plant species used for erosion control and site stabilization have been researched and used for a long time. Conversely, the amount of information available regarding the use of native plant species for erosion control and site stabilization is far less, especially with respect to what will work for the various ecological regions of a given state, such as Michigan. Hence, it is essential that users of these guidelines keep abreast of vegetation erosion guideline updates. Use professional judgment and past experience as to what will prevent erosion, meet Part 91 requirements, and result in the establishment of native vegetation genotypes adapted to the local site conditions.

The DNR and DEQ recognize that the use of native species is more expensive than using introduced species and are more difficult to obtain. However, native species with local region genotypes are the species best adapted to the site conditions and survival for the long-term, without harm to the environment or Michigan's biodiversity conservation efforts.

A number of Michigan firms which produce seed native to Michigan have formed an association called the Michigan Native Plant Producers Association. Their website is: http://www.mnppa.org/. Another source for information is the Michigan Wildflower Association. Their website is: http://www.wildflowersmich.org/. Another related site is the Michigan Association Conservation District's website on native plants. This website is: http://www.macd.org/nativeplants/nphome.html. Many county conservation districts sell native plants, as well as provide general and technical information regarding the uses and benefits of various native plant species.