



**US Army Corps
of Engineers®**
St. Paul District

Appendix K: Environmental

Fargo Moorhead Metropolitan Area Flood Risk Management Project **Diversion Inlet Structure**

Engineering and Design Phase

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Appendix K: Environmental

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ATTACHMENTS

Attachment K-1. MFR Guidelines for Planting Plan of the Fargo Moorhead Diversion Channel

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Appendix K: Environmental

K.1 SUMMARY OF IMPACTS

Impacts identified in the 2011 Fargo-Moorhead Metropolitan Area Flood Risk Management Feasibility Report and Environmental Impact Statement, and the Supplemental Environmental Assessment includes impacts to aquatic habitat, fish passage and connectivity, floodplain forest, wetland resources, and cultural resources.

K.1.1 Aquatic Habitat

Impacts to aquatic habitat includes riverine habitat directly affected by individual project features to include the Red River Control Structure, Red River Outlet Structure, Wild Rice River Control Structure, Sheyenne River Aqueduct, Maple River Aqueduct, and the abandonment of 5 miles of channel on the Rush and Lower Rush Rivers. There are no aquatic habitat impacts from the Diversion Inlet Structure.

K.1.2 Fish Passage and Connectivity

Impacts to fish passage and connectivity result from staging water during operation of the flood control project, reducing connectivity. Connectivity impacts are not directly part of the diversion inlet structure.

K.1.3 Floodplain Forest

The project will result in a loss of 131 acres of forested land consisting of floodplain forest, shelterbelts and small pockets of trees around farmsteads. No forests will be impacted when constructing the Diversion Inlet Structure.

K.1.4 Wetlands

Wetlands delineation for project as described in Supplemental Environmental Assessment.

Wetlands delineation has	Acres
Open Water	0.69
Seasonally Flooded Basin	1476.97
Shallow Marsh	106.38
Shrub-Carr	1.32
Wet Meadow	119.85
Total Acres	1705.20

In general, the majority of the wetlands impacted are low functioning farmed, seasonally flooded

type. There will be 5 acres of Seasonally Flooded wetlands and 2 acres of Shallow March (road ditches) impacted by the construction of the Diversion Inlet Structure.

K.1.5 Cultural Resources

Phase I cultural resources surveys of most of the diversion inlet area were conducted in 2011, 2012, 2014, and 2015. No sites needing Phase II testing and evaluation have been identified within the inlet construction work limits.

K.2 OVERALL MITIGATION FEATURES

K.2.1 Aquatic Habitat Mitigation Features

Measures considered for aquatic habitat mitigation include performing full stream restoration, stream improvement via riparian corridor restoration, designing portions of the low-flow channel to meander, and construction of fish passage.

K.2.2 Fish Passage and Connectivity

Fish Passage and connectivity impacts will be mitigated for by designing the outlet structure to be passable to fish, providing fish passage at the Rush River inlet, and providing fish passages at other existing dams in the region to include Drayton Dam and Wild Rice Dam.

Agencies have supported the idea that fish passage be provided across the widest range of conditions practicable. For example, fish passage during floods is important as fish often move in response to pulse events, particularly during spring floods. The Fargo-Moorhead project has strived to provide fish passage during all but the largest flood events.

K.2.3 Floodplain Forest

Mitigation to offset the impacts to floodplain forest includes converting 262 acres of floodplain farmland or pastured land into floodplain forest.

K.2.4 Wetlands

The channel will be planted with native wetland species on the bottom and the fringe of the side slopes of the channel, with the remainder of the side slopes being planted as a prairie swale type community. A buffer strip of several hundred feet on either side of the diversion channel up to the embankment top will help limit encroachment from agricultural activities and will provide filtering of surface runoff into the diversion channel wetlands. In consultation with several plant experts, planting guidelines and seed mixes for various zones of the channel cross section have been developed that ensure project objectives are met (Attachment K-1).

K.2.5 Cultural

Cultural resources mitigation for each Reach or feature must be completed prior to the start of construction of the Reach or feature. Monitoring for deeply buried archeological sites is not needed for diversion inlet construction.

K.3 DIVERSION INLET STRUCTURE MITIGATION FEATURES

The environmental consideration for mitigation for this feature includes providing planting guidance to facilitate wetlands in the bottom of the diversion channel. These efforts are discussed in the Feasibility Report and Environmental Impact Statement (EIS).

K.3.1 Fish Passage and Aquatic Habitat Mitigation – *Not applicable to this reach.*

K.3.2 Wetland Planting Guidelines

To meet the mitigation requirements for planting the diversion channel with wetland species the vegetation establishment guidelines for the diversion channel are attached as attachment K-1. One goal of the planting plan is to limit the potential for the establishment of undesirable species (such as cattails, willow, etc.), compatible with Conveyance criteria (resulting in a Manning's roughness n value of .03 or less), and resilient to maintenance activities.

Because the Diversion Inlet Structure will be constructed before wetlands can be planted in the diversion channel, separable mitigation will have to be sought for the 5 acres of wetlands that will be impacted. This will either be done using credits available through Ducks Unlimited or by creating a larger wetland mitigation project near Oxbow North Dakota. The 2 acres of Shallow Marsh wetlands that will be impacted will be mitigated for by the creation of new ditches during the Hwy 16 and 17 road realignment.

K.4 CULTURAL RESOURCES

No National Register of Historic Places listed or eligible sites are located in the diversion inlet construction area. Within one-half mile of the diversion inlet structure location, there are rural residences less than 50 years old to the north, a farmstead (FM19-8) to the southeast, and a prehistoric isolated artifact (32CSX376) to the south; all are not eligible to the National Register.

Between one-half mile and one mile of the diversion inlet structure location, there are rural residences less than 50 years old to the northwest, two historic archeological sites (32CS5182, 32CS5186) to the north, a farmstead (32CS5166) to the northeast, a farmstead less than 50

years old to the east, and a farmstead (32CS5154) to the southeast; all are not eligible to the National Register. An unrecorded farmstead approximately three-quarters mile to the southwest of the diversion inlet structure location has not had its eligibility to the National Register evaluated.

Between one mile and one-and-one-half miles of the diversion inlet structure location, there are a farmstead less than 50 years old to the northwest, rural residences less than 50 years old to the north-northwest, historic archeological site 32CS5175 to the northeast, prehistoric isolated artifact (32CSX337) to the east, historic archeological site (32CS5079) and two isolated artifacts (historic-32CSX375; prehistoric-32CSX377) to the south; all are not eligible to the National Register. An unrecorded farmstead approximately one and one-quarter miles to the southwest of the diversion inlet structure location has not had its eligibility to the National Register evaluated. A National Register-eligible farmstead (32CS5153), just over one mile to the northwest of the diversion inlet structure, is located along the centerline of the proposed diversion channel. A second National Register-eligible farmstead (32CS5168), approximately one and three-eighths miles east-southeast of the diversion inlet structure, is located along the connecting channel alignment.

Based on coordination of the viewshed analysis with the North Dakota SHPO, the North Dakota SHPO has agreed with the Corps determination that EMBs and other above ground structures (inlet structure) that are 20 feet tall or less above the ground surface would not have a visual impact at over one-eighth mile. The EMBs are being designed to be 20 feet or less (21 feet allowing for subsidence) to avoid all but minor visual impacts. Where the EMBs or other features have to be over 20 feet above ground, we will have to determine what if any National Register of Historic Places eligible or listed properties (historic properties) are within one-half mile of that taller feature and just what the extent of the visual impact would be (none, minor, moderate, or major) on a case by case basis. Visual impacts which cannot be avoided can be minimized by such things as trees, prairie grasses, and other plants breaking up the view of the structure or blending the structure in with the adjacent landscape.

The diversion inlet gates will normally be in a down position, and less than 20 feet tall or less above the adjacent ground surface, and will have no or minor visual impacts to historic properties. When the project is operating at the 10-year or greater flood event, the gates will be in the up/raised position, with their tops at 37 feet above the ground. This will be a temporary visual impact, sort of like noise and dust during construction.

The lifting mechanism for each gate and its platform, however, will be permanently located at approximately 37 feet above the ground surface. Likewise, the control building (approximately

24 feet by 30 feet) for the inlet structure, which will be situated on top the adjacent EMB, will extend up to 40 feet above the existing ground surface (20 feet above the top of the EMB). The mechanical platforms for the gates and the control building will have major visual impacts to historic properties within one-half mile, moderate visual impacts to historic properties from one-half to one mile, and minor to no visual impacts to historic properties over one mile distance from these features. Increasing the size or height of the control building to include space for maintenance equipment and other storage would potentially increase the degree of visual impacts possible at each half-mile distance.

There are no National Register eligible or listed historic properties within one mile of the diversion inlet structure with its gate lifting mechanisms and its associated control building. The two unrecorded farmsteads at three-quarters mile and at one and one-quarter miles to the southwest are outside of the diversion inlet and channel construction work limits, but may have moderate to minor visual impacts from the above inlet features. Their eligibility to the National Register needs to be evaluated to determine if there will be any inlet structure related visual impacts to them.

National Register-eligible farmstead 32CS5153 at just over one mile distance to the northwest would have minor visually impacts, except that it will be removed during diversion channel construction. Likewise, National Register-eligible farmstead 32CS5168 at one and three-eighths miles to the east-southeast would have minor to no visual impacts, except that it will be removed during construction of the connecting channel upstream of the inlet structure. Neither of these two farmsteads will be extant by the time the diversion inlet structure is operating.

Compliance with Section 106 of the NHPA is being accomplished for the FMM Project in general and the diversion inlet structure in particular based on the stipulations in the Programmatic Agreement for that project and Amendment No. 1 to that Programmatic Agreement.

K.5 ENVIRONMENTAL SURVEYS AND MONITORING

Not applicable for this feature.

K.6 NEPA COMPLIANCE

The proposed plan for the project was discussed in the 2011 Fargo-Moorhead Metropolitan Area Flood Risk Management Final Feasibility Report and Environmental Impact Statement. A Supplemental Environmental Assessment, Design Modifications to the Fargo Moorhead Metropolitan Flood Risk Management Project, dated September 2013 was prepared to address changes in impacts caused by

alignment changes, construction of levees in-town to provide the opportunity to allow more flow through town, and the construction of a levee around the communities of Hickson, Bakke, and Oxbow. Included in this EA is a description of the inlet structure indicating that gates be added to this structure. The Finding of No Significant Impact (FONSI) was signed on 19 September 2013. An Environmental Compliance Review memo explaining how the wetlands will be mitigated for and describing the change to 50-foot wide gates has been completed.

MEMORANDUM FOR RECORD

SUBJECT: Guidelines for Reach 1 Planting Plan of the Fargo Moorhead Diversion Channel.
Prepared by: Jonathan Sobiech and Megan McGuire

1. **References:** References and supporting documentation are listed below.
 - a) Minnesota Board of Water & Soil Resources
(http://www.bwsr.state.mn.us/native_vegetation/)
 - b) MN/DOT website (Seed Mix Design Manual)
<http://www.dot.state.mn.us/environment/erosion/pdf/native-seed-mix-dm.pdf>
2. **Purpose:** To establish guidance for the planting of the Fargo Moorhead Metropolitan diversion channel. The recommended plan will be reviewed by Engineering Division to ensure the recommended plant species will be acceptable for passing the desired flow based on the hydraulic modeling.
3. The planting area consists of the entire diversion channel and its features which include: the excavated material berm piled along the diversion channel (zone 1), the 1V:7H slopes leading down to the bottom of the channel (zones 2 and 3), the 2% slopes leading to the low flow channel (zone 4) and finally the low flow channel (zone 5) see figure 1.
4. There will be no features designed specifically for wetland establishment. Rather, the plant species are chosen based on the survivability of what the diversion channel will support based on the hydrology and soils. Planting a carefully selected species mix will benefit the project in a number of ways to include: wildlife habitat, providing nutrients, water quality, outcompeting less desirable species such as sandbar willow and cattails, and erosion prevention.
5. The hydraulic models for this project assumed a roughness Manning's n value of .03, and assumptions were made early on that any woody vegetation would have n values greater than what was modeled for. Therefore no woody plants are being considered for this planting plan.
6. Performance of the Breckenridge diversion, as well as past experiences with dry dams, have shown that extended inundation (particularly if the entire plant is submerged) during the growing season will kill even hardy species such as cattails, reed canary grass and Phragmites. With the FM project it is possible that the diversion channel will have fairly high elevations of water for up to several weeks into the growing season. Since mudflats may be an unavoidable result in severe cases, the planting plan should include some fast-colonizing species of mudflats (e.g., smartweeds, water plantain, and blunt spikerush). These plants will provide a seedbank which will help rapidly re-colonize the mudflats if/when they develop.
7. Bulrushes and lake sedge stand up well to flowing water (up to a point of course) and can tolerate short-term submergence during the growing season. Prairie cord-grass is excellent for preventing soil erosion if given enough time to develop its root/rhizome system and was the dominant species in wet prairie swales and bed of Glacial Lake Agassiz. These species have been incorporated into the

recommended species mix for this project as well as many more common persistently or temporarily flooded species.

8. Experts from the Engineer Research and Development Center (ERDC), Fish and Wildlife Service (FWS), Natural Resource Conservation Service (NRCS), Corps Regulatory office in St. Paul and the University of Minnesota (UMN) were consulted as to what plants would be the best suited for the diversion plantings. Based on their input the following planting plan criteria were developed.

Criteria:

- a) A diversity of species established to help prevent the introduction of non-native invasive species that are common in the area
 - b) Vegetation selected must have a Manning's 'n' value of approximately .03 (must ensure that the species selected satisfy the roughness that was put into the model).
 - c) Select native plant species common in the area.
 - d) Wetland species at the bottom and near the bottom of the channel.
 - e) Select species that can re-colonize quickly if they die-off.
 - f) A minimum of 4-6 inches of topsoil will be incorporated into existing soil before planting
 - g) Site preparation prior to planting is very important.
 - h) Can be either mowed or burned after establishment.
 - i) Stabilize soils and prevent erosion.
9. Recommended Species Mixes: The seed mixes for this project are designed or selected to increase diversity, create competition for invasive species, and to promote plant community stability. They also are satisfactory to ensure that the roughness created by these plants will not have an adverse impact on the conveyance of channel flows.

The native seed mix design manual from the MNDOT was used to guide in the selection of seed mixes and/or specific plant recommendations. For zones 1-3 seed mixes were adapted from the manual, and are based on standard mixtures used by MNDOT, BWSR and MNDNR. Additional species were also added for more diversity and enhanced adaptation to the environmental conditions, and plants more adapted to North Dakota were added to the Minnesota mixes. For zones 4-5 the seed mix is made up of a combination of existing seed mixes with additional species incorporated to help satisfy the other criteria of the planting plan.

A cover crop of oats and/or winter wheat with native soil stabilizing grasses will also be used for all seed mixes.

- a) Zone 1: The seed mix proposed for zone 1 is the Mesic Prairie (Table 1). Warm-season prairie grasses will have the highest success rate if planted between April 15 and June 30. Prairie forbs and sedges will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- b) Zone 2: The seed mix proposed for zone 2 is the recommended Wet Prairie Mix (Table 2). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30. Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will

- depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- c) Zone 3: The seed mix proposed for zone 3 is the recommended Wet Meadow mix (Table 3). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30). Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- d) Zones 4 and 5: The seed mix proposed for zones 4 and 5 is a combination of the recommended Temporary Flooded, Persistently Flooded, and from expert opinions to create a combined mix (Table 4). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30). Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The majority of species in the wetter zones are cool-season grasses and sedges. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time. In addition to seeding, Zone 4 will be planted with plugs of certain species to promote rapid stabilization of the low-flow channel banks. Many wet plant species do not succeed from seed, but have very high success rates and rapid growth from plugs.
10. Site Preparation: The majority of the land that will be impacted for this project will be agricultural. Sites that are currently in agriculture often have effective weed control and are in good condition for seeding. Topsoil from agricultural fields will be spread across the site. This soil will likely have few perennial weeds, but will certainly have annual weeds that will compete with the native vegetation, especially during establishment.
11. Topsoil: Topsoil is proposed for this project to provide a higher nutrient medium for the plants. However, care must be taken to ensure topsoil to be used is free of any upland and wetland invasive species, particularly reed canary grass. Soil stockpiles will be treated with herbicide and/or cover crops during construction to prevent contamination with weed seeds. The topsoil will be incorporated or mixed with the existing substrate through periodic disking, and any compaction that occurs will be loosened before final seedbed preparation. A minimum of 6-8 inches of topsoil should be incorporated to a depth of 2 inches into the clay subsoil.
12. Seedbed Preparation: There will be more information on this as we move closer to planting but for a place holder we will use a couple different methodologies for seedbed preparation. Where we will be planting with a traditional native seed drill we will require a smooth firm seedbed. This will require harrowing and rolling the surface to make it acceptable for this type of planting; this will prevent the seed from being buried too deep. Broadcast seeding will be ok on areas that have been disked or where the topsoil has been incorporated as long as the soil is allowed time to settle. It may be required to roll or cultipack following a broadcast seeding to ensure the seed doesn't blow away. A cover crop will be planted in the topsoil. If we are able to plant directly into standing stubble, the soil

will have settled sufficiently for seeding. If the cover crop must be tilled and incorporated into the topsoil, harrowing, rolling, or cultipacking will be required. Other options for some of the seeding may include hydro seeding or manually planting plants. Regardless of methodology of seed planting, shallow planting is key between 0 to ¼ inch deep depending on the size of the seed. In general, larger-seeded prairie grasses do best with drilling, while, sedges, and smaller seeded grasses do best with broadcast seeding. If the seeding occurs in the spring, consider using broadcast seeding, if possible, because forbs and sedges will already be disadvantaged. Broadcast and drill seeding can be used in combination to ensure the best establishment.

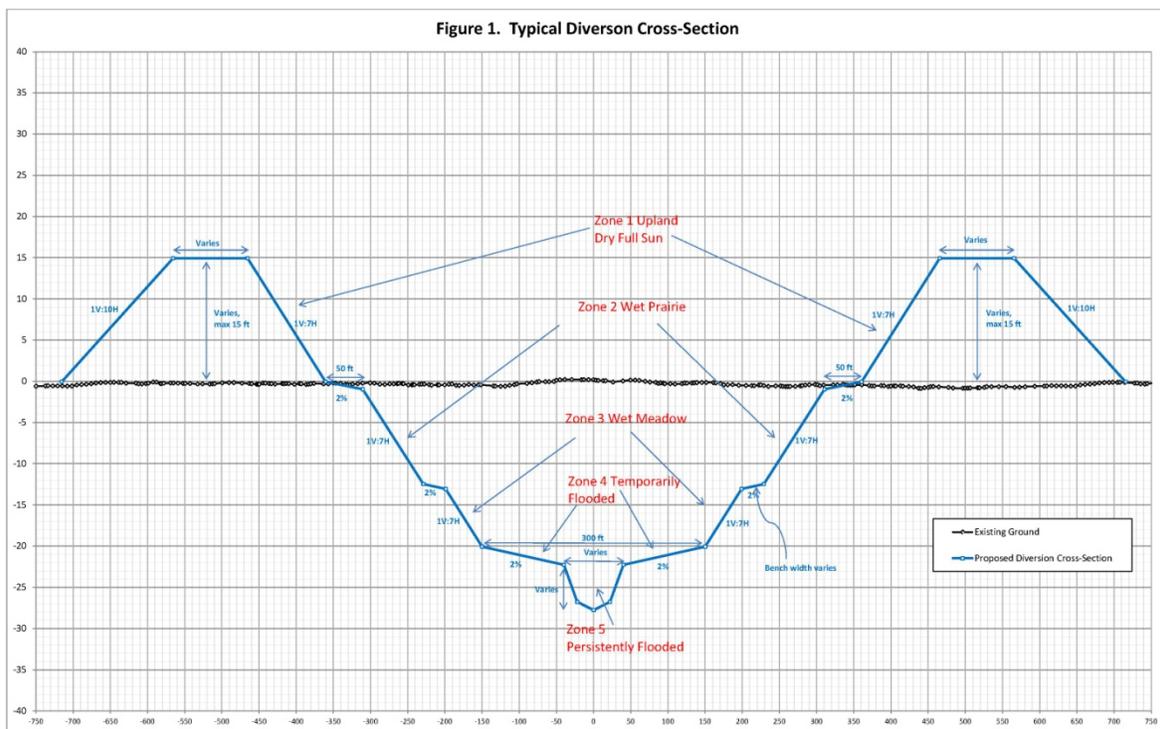


Table 1. ZONE 1 MESIC PRAIRIE SEED MIX**Forbs**

Description	
<i>Agastache foeniculum</i>	Anise Hyssop
<i>Allium stellatum</i>	Prairie Onion
<i>Apocynum sibiricum</i>	Clasping Dogbane
<i>Artemisia ludoviciana</i>	White sagebrush
<i>Asclepias verticillata</i>	Whorled Milkweed
<i>Astragalus canadensis</i>	Canada Milk Vetch
<i>Dalea candida</i>	White Prairie Clover
<i>Dalea purpurea</i>	Purple Prairie Clover
<i>Desmodium canadense</i>	Showy Tick Trefoil
<i>Galium boreale</i>	Northern Bedstraw
<i>Glycyrrhiza lepidota</i>	Wild Licorice
<i>Helianthus pauciflorus</i>	Showy Sunflower
<i>Heliopsis helianthoides</i>	Early Sunflower
<i>Heuchera richardsonii</i>	Prairie Alumroot
<i>Lathyrus venosus</i>	Veiny Pea
<i>Liatris aspera</i>	Rough Blazing Star
<i>Liatris pycnostachya</i>	Prairie Blazing Star
<i>Monarda fistulosa</i>	Wild Beragmot
<i>Oenothera biennis</i>	Common Evening Primrose
<i>Pedicularis canadensis</i>	Wood Betony
<i>Pycnanthemum virginianum</i>	Mountain Mint
<i>Ratibida columnifera</i>	Long-headed Coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Solidago nemoralis</i>	Old Field Goldenrod
<i>Solidago rigida</i>	Stiff Goldenrod
<i>Solidago speciosa</i>	Showy Goldenrod
<i>Symphyotrichum ericoides</i>	Heath Aster
<i>Symphyotrichum laeve</i>	Smooth Blue Aster
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Zizia aptera</i>	Heart-leaf Golden Alexanders

TREES, SHRUBS & VINES

Description	
<i>Amorpha canescens</i>	Lead Plant

GRASSES, SEDGES & RUSHES

Description	
<i>Andropogon gerardii</i>	Big Bluestem
<i>Bouteloua curtipendula</i>	Side-Oats Grama
<i>Bouteloua gracilis</i>	Blue Grama
<i>Bromus kalmii</i>	Prairie Brome
<i>Carex brevior</i>	Shortbeak Sedge
<i>Deschampsia cespitosa</i>	Tufted Hairgrass
<i>Elymus canadensis</i>	Canada Wild Rye
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Hesperostipa spartea</i> (syn. <i>Stipa spartea</i>)	Porcupine Grass
<i>Koeleria cristata</i>	June Grass
<i>Muhlenbergia glomerata</i>	Marsh Muly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switichgrass
<i>Pascopyrum smithii</i>	Western Wheatgrass
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Sorghastrum nutans</i>	Indian Grass
<i>Sphenopholis obtusata</i>	Prairie Wedgegrass
<i>Sporobolus heterolepis</i>	Prairie Dropseed
<i>Stipa viridula</i> (syn. <i>Nassella viridula</i>)	Green Needle Grass

Table 2. ZONE 2 WET PRAIRIE SEED MIX**Forbs**

Description	
Anemone canadensis	Canada Anemone
Apocynum sibiricum	Clasping Dogbane
Asclepias incarnata	Swamp Milkweed
Aster puniceus	Swamp Aster
Dalea purpurea	Purple Prairie Clover
Desmodium canadense	Showy Tick Trefoil
Doellingeria umbellata	Flat-Topped Aster
Eupatorium maculatum	Joe Pye Weed
Eupatorium perfoliatum	Boneset
Euthamia graminifolia	Grass-leaved Goldenrod
Galium boreale	Northern Bedstraw
Helenium autumnale	Sneezeweed
Helianthus grosseserratus	Saw-tooth Sunflower
Lathyrus venosus	Veiny Pea
Liatris ligulistylis	Meadow Blazing Star
Liatris pycnostachya	Prairie Blazing Star
Lobelia siphilitica	Great Blue Lobelia
Lysimachia quadriflora	Prairie Loosestrife
Mimulus ringens	Monkey Flower
Pycnanthemum virginianum	Mountain Mint

<i>Solidago gigantea</i>	Late Goldenrod
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Vernonia fasciculata</i>	Common Ironweed
<i>Veronicastrum virginicum</i>	Culver's Root
<i>Zizia aurea</i>	Golden Alexanders

GRASSES, SEDGES & RUSHES

Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Blustem
<i>Bromus ciliatus</i>	Fringed Brome
<i>Bromus kalmii</i>	Prairie Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Calamagrostis stricta</i>	Northern reedgrass
<i>Carex buxbaumii</i> *	Buxbaum's Sedge
<i>Carex pellita</i> *	Wooly Sedge
<i>Carex praegracilis</i>	Freeway Sedge
<i>Carex sartwellii</i> *	Sartwell's Sedge
<i>Carex stricta</i>	Upright Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Deschamsia cespitosa</i>	Tufted Hairgrass
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Elymus virginicus</i>	Virginia Wild Rye

<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Leymus triticoides</i>	Beardgrass Wild Rye
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Pascopyrum smithii</i>	Western Wheatgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass
<i>Sporobolus heterolepis</i>	Prairie Dropseed
<i>Stipa viridula</i> (syn. <i>Nassella viridula</i>)	Green Needle Grass

* Indicates species that are highly desired.

Table 3. ZONE 3 WET MEADOW SEED MIX

Forbs

Description	
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Aster puniceus</i>	Swamp Aster
<i>Boltonia asteroides</i>	False Aster
<i>Doellingeria umbellata</i>	Flat-topped Aster
<i>Epilobium glandulosum</i>	Northern Willow Herb
<i>Eupatorium maculatum</i>	Joe Pye Weed

<i>Eupatorium perfoliatum</i>	Boneset
<i>Euthamia graminifolia</i>	Grass-leaved Goldenrod
<i>Helenium autumnale</i>	Sneezeweed
<i>Helianthus grosseserratus</i>	Saw-tooth Sunflower
<i>Hypoxis hirsute</i>	Yellow Star Grass
<i>Lobelia siphilitica</i>	Great Blue Lobelia
<i>Lycopus americanus</i>	Water Horehound
<i>Lysimachia ciliata</i>	Fringed Loosestrife
<i>Mentha arvensis</i>	Wild Mint
<i>Mimulus ringens</i>	Monkey Flower
<i>Pedicularis lanceolata</i>	Marsh Betony
<i>Pycnanthemum virginianum</i>	Mountain Mint
<i>Solidago gigantea</i>	Late Goldenrod
<i>Symphyotrichum lanceolatum</i>	Panicked Aster
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Vernonia fasciculata</i>	Common Ironweed
<i>Veronicastrum virginicum</i>	Culver's Root
<i>Zizia aurea</i>	Golden Alexanders

GRASSES, SEDGES & RUSHES

Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Bluestem
<i>Beckmannia syzigachne</i>	American Sloughgrass
<i>Bromus ciliatus</i>	Fringed Brome
<i>Bromus kalmii</i>	Prairie Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Calamagrostis stricta</i>	Northern reedgrass
<i>Carex bebbii</i>	Bebb's Sedge
<i>Carex buxbaumii</i> *	Buxbaum's Sedge
<i>Carex comosa</i>	Bottlebrush Sedge
<i>Carex lasiocarpa</i>	Woollyfruit Sedge
<i>Carex pellita</i> *	Woolly Sedge
<i>Carex praegracilis</i> *	Freeway Sedge
<i>Carex sartwellii</i> *	Sartwell's Sedge

<i>Carex scoparia</i>	Broom Sedge
<i>Carex sprengei</i>	Sprengel's Sedge
<i>Carex stipata</i>	Awlfruit Sedge
<i>Carex stricta</i> *	Tussock Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Distichlis spicata</i>	Inland Saltgrass
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Elymus virginicus</i>	Virginia Wild Rye
<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Hierochloa odorata</i>	Sweetgrass
<i>Hordeum jubatum</i>	Foxtail Barley
<i>Juncus tenuis</i>	Path Rush
<i>Leersia oryzoides</i>	Rice Cutgrass
<i>Leymus triticoides</i>	Beardless Wild Rye
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Scolochloa festucacea</i>	Common Rivergrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass

* Indicates the species that are highly desired.

Table 4. ZONE 4 and 5 BOTTOM MIX

Forbs

Description	
<i>Acorus americanus</i>	Sweet Flag
<i>Acorus calamus</i>	Sweet Flag
<i>Alisma trivale</i>	Nothern Water Plantain
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Bidens cernua</i>	Nodding Bur Marigold
<i>Epilobium glandulosum</i>	Northern Willow Herb
<i>Eupatorium maculatum</i>	Joe Pye Weed
<i>Impatiens capensis</i>	Spotted Touch-me-not

<i>Iris versicolor</i>	Northern Blue Flag
<i>Lycopus americanus</i>	Water Horehound
<i>Lysimachia ciliata</i>	Fringed Loosestrife
<i>Mentha arvensis</i>	Wild Mint
<i>Mimulus ringens</i>	Monkey Flower
<i>Penthorum sedoides</i>	Ditch Stonecrop
<i>Physostegia virginiana</i>	Obedient Plant
<i>Polygonum pensylvanicum</i>	Pinkweed
<i>Polygonum punctatum</i>	Smartweed
<i>Polygonum sagittatum</i>	Tear Thumb
<i>Rumex orbiculatus</i>	Bitter Dock
<i>Sagittaria latifolia</i>	Common Arrowhead
<i>Scutellaria laterifolia</i>	Mad-dog Skullcap
<i>Sium suave</i>	Tall Water Parsnip
<i>Sparganium eurycarpum</i>	Great Bur Reed
<i>Stachys palustris homotricha</i>	Woundwort
<i>Teucrium canadense</i>	Germander
GRASSES, SEDGES & RUSHES	
Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Bluestem
<i>Beckmannia syzigachne</i>	American Sloughgrass
<i>Bromus ciliatus</i>	Fringed Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Carex aquatilis</i> *	Water Sedge
<i>Carex aurea</i>	Golden Sedge
<i>Carex bebbii</i> *	Bebb's Sedge
<i>Carex comosa</i>	Bottlebrush Sedge
<i>Carex lacustris</i> *	Lake Sedge
<i>Carex lasiocarpa</i> *	Woollyfruit Sedge
<i>Carex pellita</i> *	Woolly Sedge
<i>Carex praegracilis</i>	Freeway Sedge
<i>Carex sartwellii</i> *	Sartwell's Sedge
<i>Carex scoparia</i> *	Broom Sedge
<i>Carex stipata</i>	Awlfruit Sedge

<i>Carex stricta</i>	Tussock Sedge
<i>Carex utriculata</i> *	Common Yellow Lake Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Distichlis spicata</i>	Inland Saltgrass
<i>Eleocharis obtusa</i>	Blunt Spikerush
<i>Eleocharis palustris</i>	Common Spikerush
<i>Elymus virginicus</i>	Virginia Wild Rye
<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Hierochloa odorata</i>	Sweetgrass
<i>Hordeum jubatum</i>	Foxtail Barley
<i>Juncus balticus</i>	Baltic Rush
<i>Juncus effusus</i>	Common Rush
<i>Leersia oryzoides</i>	Rice Cutgrass
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Scirpus acutus</i>	Hardstem Bulrush
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Scirpus fluviatilis</i>	River Bulrush
<i>Scirpus pungens</i>	Common Three-Square
<i>Scirpus validus</i>	Softstem Bulrush
<i>Scolochloa festucacea</i>	Common Rivergrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass

* Indicates species that are highly desired.