# Table of Contents

**INTRODUCTION**....................................................................................................................... IV

**VOLUME I .................................................................................................................. 1-1**

1.0 BEST MANAGEMENT PRACTICE .............................................................. 1-1

1.1 PLANNING........................................................................................................ 1-2

1.1.1 Scheduling ........................................................................................................ 1-2

1.1.2 Plan and Profile ............................................................................................ 1-2

1.1.3 Cultural Resources ......................................................................................... 1-3

1.1.4 Site Preparation ............................................................................................ 1-3

1.2 CONSTRUCTION ACTIVITIES .......................................................................... 1-4

1.2.1 Access Roads ................................................................................................ 1-4

1.2.2 Substation...................................................................................................... 1-5

1.2.3 Maintenance ................................................................................................ 1-5

1.3 EROSION CONTROL ......................................................................................... 1-7

1.3.1 Preservation of Existing Vegetation ............................................................... 1-8

1.3.2 Topsoil Segregation ...................................................................................... 1-10

1.3.3 Mulch, Blankets, and Mats ........................................................................ 1-10

1.3.4 Slope Breakers ............................................................................................ 1-13

1.3.5 Directional Tracking and Tillage ................................................................. 1-15

1.3.6 Soil Binders ................................................................................................ 1-15

1.3.7 Streambank Stabilization ............................................................................ 1-15

1.4 SEDIMENT CONTROL .................................................................................... 1-17

1.4.1 Silt Fence ..................................................................................................... 1-17

1.4.2 Silt Curtains ................................................................................................ 1-17

1.4.3 Sediment Barriers ....................................................................................... 1-20

1.4.4 Sediment Traps .......................................................................................... 1-20

1.4.5 Fiber Rolls ................................................................................................... 1-21

1.4.6 Check Dams ................................................................................................. 1-21

1.4.7 Inlet Protection ............................................................................................ 1-23

1.4.8 Street Cleaning ............................................................................................ 1-23

1.4.9 Vegetative Buffer ....................................................................................... 1-23

1.4.10 Construction Entrance and Exit .............................................................. 1-26

1.4.11 Dust Control ............................................................................................. 1-26

1.5 VEGETATIVE STABILIZATION .................................................................... 1-28

1.5.1 Illinois .......................................................................................................... 1-29

1.5.2 Iowa ............................................................................................................ 1-35
Table of Contents

1.5.3  Minnesota ........................................................................................................ 1-37
1.5.4  Wisconsin ..................................................................................................... 1-45
1.5.5  Sodding ....................................................................................................... 1-49
1.5.6  Local Seed Vendors .................................................................................... 1-49

1.6  STORMWATER TREATMENT ........................................................................... 1-51
1.6.1  Infiltration Systems .................................................................................... 1-51
1.6.2  Constructed Wetland .................................................................................. 1-51
1.6.3  Retention and Detention Pond Systems ...................................................... 1-51

1.7  GENERAL OPERATIONS ................................................................................. 1-52
1.7.1  Residential Areas ....................................................................................... 1-52
1.7.2  Highway and Road Crossings ..................................................................... 1-52
1.7.3  Wetland Crossings ..................................................................................... 1-53
1.7.4  Stream and River Crossings ..................................................................... 1-57
1.7.5  Trout Stream ............................................................................................. 1-61

1.8  POLLUTION PREVENTION MANAGEMENT MEASURES .......................... 1-62
1.8.1  Spill Cleanup ............................................................................................... 1-62
1.8.2  Trash and Debris ....................................................................................... 1-65
1.8.3  Hazardous Material .................................................................................. 1-65

1.9  GENERAL PROVISIONS .................................................................................. 1-66
1.9.1  Maintenance ............................................................................................... 1-66
1.9.2  Inspections ................................................................................................. 1-68
1.9.3  Record Keeping and Reporting .................................................................. 1-68

List of Tables

Table 1  Erosion Fabric Categories ........................................................................ 1-12
Table 2  Slope Breaker Spacing .......................................................................... 1-13
Table 3  Illinois Permanent Seeding Mixture ...................................................... 1-32
Table 4  Iowa Temporary Seed Mixture ............................................................... 1-35
Table 5  Iowa Permanent Seed Mixture ............................................................... 1-37
Table 6  Minnesota Temporary Seed Mixture ...................................................... 1-40
Table 7  Minnesota Mixture 150 .............................................................. 1-40
Table 8  Minnesota Permanent Seed Mixture ...................................................... 1-44
Table 9  Minnesota General Fertilizer Recommendations .................................. 1-45
Table 10  Wisconsin Temporary Seeding Mixture ............................................... 1-46
Table 11  Wisconsin Permanent Seed Mixture .................................................... 1-47
Table 12  After Construction BMP Maintenance Activity and Schedule .......... 1-66
List of Figures

Figure 1 Dairyland Power Cooperative Service Area.................................................................................. v
Figure 2 Slope Breaker Diagram .................................................................................................................. 1-14
Figure 3 Illinois Soils Map ......................................................................................................................... 1-31
Figure 4 Iowa Soils Map ............................................................................................................................... 1-36
Figure 5 Minnesota Soils Map .................................................................................................................... 1-39
Figure 6 Wisconsin Soils Map ..................................................................................................................... 1-48

Detail Sheets

Detail Sheet 1 Access Road Typical Sections .............................................................................................. 1-6
Detail Sheet 2 Preservation of Existing Vegetation ..................................................................................... 1-9
Detail Sheet 3 Silt Fence ............................................................................................................................... 1-18
Detail Sheet 4 Silt Curtain ............................................................................................................................ 1-19
Detail Sheet 5 Fiber Roll ............................................................................................................................... 1-22
Detail Sheet 6 Inlet Protection Type D ......................................................................................................... 1-24
Detail Sheet 7 Inlet Protection Type C .......................................................................................................... 1-25
Detail Sheet 8 Construction Entrance and Exit .......................................................................................... 1-27
INTRODUCTION

Dairyland Power Cooperative (Dairyland) is a generation and transmission cooperative based in La Crosse, Wisconsin that provides wholesale electrical energy to 25 member cooperatives and 20 municipalities who deliver the energy needs to over 500,000 people.1 Dairyland’s service area comprises 62 counties in Illinois, Iowa, Minnesota, and Wisconsin (Figure 1). Dairyland owns and operates over 3,000 miles of transmission line, over 200 distribution and transmission substations, numerous communication sites, and generation and utility properties.

Dairyland is committed to the preservation and protection of precious natural resources. This best management practice (BMP) manual and field guide were created in acknowledgment of that commitment. This manual will provide Dairyland staff, consultants, and contractors with a comprehensive source for BMPs related to earth disturbing activities during construction, repair, and maintenance work associated with transmission lines, substations, and other cooperative projects. The associated field guide is a water-proofed version of this manual, which summarizes key erosion and sediment control points for use by field crews. Federal and state environmental permit information was also included in this document for reference. These practices and procedures, when properly implemented, will minimize or prevent erosion and sediment pollution from adversely affecting sensitive resources, such as, streams, ponds, lakes, wetlands, and natural vegetative.

Erosion and sediment control measures are generally recognized as a necessary component of large construction projects. It is equally important to note that those same measures apply to all earthmoving activity, regardless of size or scope. The smallest transmission line repair activity could change water temperature in nearby trout streams or transport noxious weeds across property lines if crucial BMPs are not applied where required. BMPs are, in fact, required in some form for all activities to preserve sensitive resources, regardless of the project size.

This BMP manual provides a comprehensive reference source for BMPs for construction activities and environmental compliance/permit policies and procedures. This manual must be periodically updated to reflect changes in BMPs in regulatory policy and in enforcement trends affecting and/or influencing the activities of Dairyland.

---

Figure 1
Dairyland Power Cooperative
Service Area

Legend
- Minnesota
- Iowa
- Wisconsin
All individuals working on construction projects are responsible for complying with permit requirements and the associated BMPs as designed and detailed in this manual and further specified by the Project Manager within site plans. If questions arise concerning environmental requirements, the Project Manager should interpret compliance requirements. If the Project Manager is not available or able to resolve an issue, Dairyland’s Manager, Siting and Regulatory Affairs should be notified. Some construction projects may require additional local environmental permits that could contain additional requirements that may be more restrictive than those identified in this manual. Compliance with local permit requirements is mandatory.

This manual is presented in two volumes. Volume I contains BMPs necessary to protect sensitive resources from erosion and sediment transport in stormwater runoff when constructing transmission lines, access roads, substations, other utility-related improvements, or when conducting maintenance operations in or around sensitive resources. Volume II contains a comprehensive list of federal and state permits required for construction and maintenance activities.
VOLUME I

1.0 BEST MANAGEMENT PRACTICE

Best management practices (BMPs) are structural, nonstructural, and managerial techniques recognized as the most effective and practical means to control non-point source pollutants, yet are compatible with the productive use of the resource to which they are applied\(^2\). For the purpose of this manual, BMPs presented here are specific to controlling erosion and preventing the transport of sediment-laden stormwater off construction and maintenance sites.

This volume contains the following sections:

- Planning
- Construction Activities
- Erosion Control
- Sediment Control
- Vegetative Stabilization
- Stormwater Treatment
- General Operations
  1. Residential Areas
  2. Highway and Road Crossings
  3. Wetland Crossings
  4. Stream Crossings
- Pollution Prevention Management Measures
- General Provisions

---

1.1 **PLANNING**

Planning for the cooperative’s construction and maintenance-related activities is a crucial part of the successful execution of projects. This step forces the Project Manager to think through factors linked to protecting sensitive resources, such as BMPs, scheduling, right-of-way (ROW) plan and profile, cultural resources, site preparation, and project-related permits. The significance of scheduling, development of site plan and profile, identification of cultural resources, and site preparation are discussed in detail below. BMPs and project-related permits will be addressed in later sections of this manual.

1.1.1 **Scheduling**

The purpose of a schedule of construction or maintenance activities is to reduce potential impacts to sensitive resources. The schedule serves as a means to incorporate all activities related to a given project. The following steps are useful when completing a construction schedule:

1. Outline all land disturbing activities.
2. List BMPs needed to contain sediment and reduce erosion.
3. List required permits, agency review period, and requirements.
4. Combine the outline and lists in a logical order to set up an effective schedule.

The appropriate scheduling and sequencing of construction activities is a cost-effective way to help accomplish the goal of protecting sensitive resources by reducing the amount of land cleared, providing needed controls and restoring vegetation in an efficient and effective manner.

1.1.2 **Plan and Profile**

A plan and profile is a valuable visual aid tool for negotiators, appraisers, and attorneys involved in acquisition transactions. It also helps property owners understand why and how their properties are being affected. The preparation of the ROW plan and profile should begin following completion of the preliminary survey.

The plan and profile should include the owner’s names, tract numbers, legal descriptions, land lines and property lines, section corners and ties to the corners, stations, and offsets at each property line and turn point, project centerline from which can be derived new ROW and easements, area of the tract to be purchased less that portion previously designated as public

---

ROW, limits of construction, width of new roadway, grade changes, and any other design or construction details as warranted. The plan and profile also notes topographical items that affect the project, such as buildings, underground cisterns/septic tanks, permanent yard and farm appliances, sidewalks, paved or unpaved driveways, trees/hedges/shelterbelts, waterlines/steams/lakes, fences, or above and below ground utilities.

1.1.3 Cultural Resources

The cultural resource management (CRM) process is designed to provide federal and state agencies the information necessary to determine whether a project has the potential to affect significant archaeological sites, buildings, structures, places, or objects. The federal rules identify significant properties as those that are eligible for listing on the National Register of Historic Places (NRHP) and that are governed by Section 106 of the National Historic Preservation Act (NHPA).

At a local level, the CRM process provides similar information that addresses state historic preservation laws and local ordinances. Cultural resource surveys done early in the project planning process provide an opportunity to anticipate future cultural resource obligations and remain in compliance with federal and state laws that govern the treatment of these properties. Areas of high potential for cultural resources and potentially significant historic properties can be avoided or minimized through early identification.

1.1.4 Site Preparation

The preparation of a site is a step-by-step process that includes analysis of drainage, soils, vegetative cover, and most importantly, potential environmental concerns. Steps may vary depending on the region, state, or town, but those are universal site preparation issues that must always be considered.

**Site Particulars**

- Disturb and then restore more small areas, rather than few large areas
- Leave as much undisturbed vegetation as possible
- Minimize the time of disturbance
- Break up slope lengths and flow concentrations, and minimize slope exposure time
1.2 CONSTRUCTION ACTIVITIES

Construction activities consist of projects that involve the disturbance or movement of earthen material. These projects include, but are not limited to, building and maintaining access roads, constructing substations, erecting transmission towers or poles, and constructing other cooperative improvements.

All activities must be scheduled and executed to minimize the exposure of soil to erosion and provide ways to prevent sediment from leaving the project site. Installation of temporary control measures that will contribute to the control of erosion and sediment must be carried out prior to and concurrent with construction activities. This document provides erosion and sediment control BMPs necessary to assist with that requirement.

1.2.1 Access Roads

Access roads are temporary or permanent travel ways to provide safe, fixed routes of travel for moving equipment and supplies. Grading of these roads represents one of the largest land disturbing activities associated with construction and maintenance of transmission lines.

BMPs are described and drawings are provided in Section 1.3: Erosion Control and Section 1.4: Sediment Control.

Detail Sheet 1 shows typical sections of access road design associated with the transmission line projects.

---

1.2.2 Substation

Substations are an assemblage of equipment within a fenced area that switch, change, or regulate voltage in electric transmission and distribution systems used to transform voltages for delivery of electricity to homes and businesses.\(^5\) Substation construction requires stripping of topsoil, excavation of additional material, and placement of impervious surfaces which all aid in the transport of sediment-laden stormwater. Stormwater treatment systems, such as detention ponds or infiltration basins, are required on sites 1 acre or greater as part of National Pollutant Discharge Elimination System (NPDES) permit Stormwater Pollution Prevention Plan (SWPPP). In addition to the NPDES requirements, presented in detail in Volume II, most substations are also obligated to have an Environmental Protection Agency (EPA) required spill prevention control and countermeasure (SPCC) plan. SPCC plans ensure that facilities put in place containment and other countermeasures that would prevent hazardous spills that could reach navigable waters.\(^6\) This manual includes a pollution prevention management measures section (Section 1.8), which does not take the place of an SPCC plan, but provides information on how to report, contain, and clean up small spills.

1.2.3 Maintenance

Maintenance is an important part of the operation and management of transmission lines and substations. Maintenance may include clearing of vegetation for access roads, removal of silt/sediment for stormwater treatment facilities and/or replacement of the poles and towers of transmission lines.

Future sections include BMPs designed to assist in curtailing erosion and controlling on-site sediment release during these maintenance activities. These BMPs should be used where applicable on all Dairyland projects.

---


1.3 **Erosion Control**

Erosion control is any action taken or item used as part of a project or as a separate action to minimize the destructive effects of wind and water on surface soil. Importantly, erosion is a naturally occurring phenomenon. Accelerated erosion as a result of construction-related activities is a widespread problem affecting the environment. The problem is two-fold. First, erosion transports the most fertile part of the soil horizon. This in turn reduces the ability to vegetate areas without the aid of fertilizers. Second, the soil material that is transported ends up in sensitive resource areas, such as lakes, streams, and wetlands. Transported soil has the potential to change the entire ecology of the system. Material deposited into a stream that supports salmon has the potential to clog interstitial spaces between streambed gravel, causing juvenile salmonids to lose their source of cover and food. The NPDES permit program and local permitting agencies mandate that erosion be controlled, and sediment contained, on all project sites greater than 1 acre.

BMPs are a useful tool designed to assist in controlling construction and maintenance-related soil erosion. Use of the following BMPs will control erosion:

- Preservation of Existing Vegetation
- Topsoil Segregation
- Mulch, Blankets, and Mats
- Slope Breakers
- Directional Tracking and Tillage
- Soil Binders
- Streambank Stabilization

---


provided for each BMP at the end of this volume. Some installation details have also been included.

1.3.1 Preservation of Existing Vegetation

Preserving natural vegetation provides buffer zones and stabilized areas, which help control erosion, protect water quality, and enhance aesthetic benefits.\(^{10}\) This BMP minimizes the amount of bare soil exposed to erosive forces.

Preserving vegetation is beneficial in the following areas: floodplains, buffers, wetlands, streambanks, steep slopes, and other sensitive resource areas where it might be difficult to establish, install, or maintain erosion control devices.

Identify vegetation to be preserved during the planning process. Vegetation to be preserved should then be delineated, in the field and on design drawings, with orange temporary construction fencing (Detail Sheet 2 and Fact Sheet 1).

---

\(^{10}\) Idaho Department of Environmental Quality. \textit{Catalog of Stormwater BMPs for Cities and Counties}. 2006. 
\url{http://www.deq.state.id.us/water/data_reports/storm_water/catalog/old_version/stormwater_catalog_bmp3.pdf}

---

Photo 1.0: Minimal Footprint
Drip line of a tree or branching perimeter

Critical zone

Protection zone or critical zone

Drip line or branching perimeter

Furnish and install temporary fence at the tree's drip line or construction limits as specified, prior to any construction. When possible, place fence 25 feet beyond the drip line. Place protection signs along fence at 20' intervals.
1.3.2 Topsoil Segregation

Topsoil segregation is the act or process of separating or setting apart the topsoil from the subsoil during construction.\(^\text{11}\) Topsoil is that part of the soil profile, typically the A1 horizon, containing material, which is usually more fertile, better structured than underlying layers, and is the most important part of the soil with respect to growth of crops and pastures and its loss or degradation represents the most serious aspect of soil erosion.\(^\text{12}\)

Remove topsoil from the land in a separate layer and replace on the backfill area or, if not utilized immediately, segregate in a separate pile from other soil. If topsoil will not be placed on the backfill areas in a short time period, maintain a successful cover of quick growing plant to avoid deterioration (Section 1.5). Other means may be used so that the topsoil is preserved from wind and water erosion, remains free of any contamination by other acid or toxic material, and is in a usable condition for sustaining vegetation.

1.3.3 Mulch, Blankets, and Mats

Mulch, blankets, and mats are usually organic materials, which provide a protective cover over exposed soil and, if seeded, assist with the establishment of new vegetation. Use these measures when disturbed soils may be difficult to stabilize, including the following situations\(^\text{13}\):

- Bare or exposed soil
- Steep slopes, generally steeper than 1:3 (vertical:horizontal)
- Slopes where the erosion potential is high
- Disturbed areas where plants are slow to develop

---


Channels with flows exceeding 1 meter/second (3.3 feet/second)
Channels to be vegetated
Stockpiles
Slopes adjacent to water bodies and other sensitive resources

Mulch is any material, such as straw, sawdust, leaves, plastic film, or pine bark, that is spread on the surface of the soil to protect the soil and plant roots from the effects of raindrops, soil crusting, freezing, and evaporation. Refer to Fact Sheet 2 for more information on different types of mulches, tackifiers, and installation methods.

Erosion blankets, fabrics, or mats are similar to mulches in that their primary goal is to protect the soil from erosive forces. However, these materials are better equipped to handle exposed soils on steeper slopes.

Table 1 provides information on different service applications as per the Minnesota DOT for erosion control blankets or fabrics. The recommendations prescribed in Table 1 are also applicable in Illinois, Iowa, and Wisconsin. Refer to Fact Sheet 2, which incorporates installation details.

Where applicable, per the necessary service application and the intended use, incorporate mulch, blankets, and mats in all projects to protect bare soil.

Photo 1.0: Erosion Control Blanket Application

### Table 1
**Erosion Fabric Categories**

<table>
<thead>
<tr>
<th>Category</th>
<th>Service Application</th>
<th>Use</th>
<th>Acceptable Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Temporary</td>
<td>• Flat areas</td>
<td>Straw or wood fiber with rapidly degradable netting on one side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Around drain outlets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Along roadway shoulders, lawns, and mowed areas</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>One Season</td>
<td>• Slopes 1V:3H and steeper that are less than 50 feet long</td>
<td>Straw or wood fiber with netting on one side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ditches with gradients 2 percent or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow velocities less than 5 feet/second</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>One Season</td>
<td>• Slopes 1V:3H and steeper that are more than 50 feet long</td>
<td>Straw or wood fiber with netting on two sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ditches with gradients 3 percent or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow velocities less than 6.5 feet/second</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Semi-Permanent</td>
<td>• Ditches with gradients 4 percent or less</td>
<td>Straw, coconut, and wood fiber with netting on two sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow velocities less than 8 feet/second</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow depth 6 inches or less</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Semi-Permanent</td>
<td>• Ditches with gradients 8 percent or less</td>
<td>Coconut fiber with netting on two sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow velocities less than 15 feet/second</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow depth 8 inches or less</td>
<td></td>
</tr>
</tbody>
</table>

---

1.3.4 Slope Breakers\textsuperscript{17}

Slope breakers, also known as “thank you Ma’am,” are constructed of materials, such as soil, silt fence, staked hay or straw bales, or sand bags, are berms along slopes which are intended to reduce runoff velocity and divert water off the construction ROW. Slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbodies, wetlands, and road crossings at the spacing specified in Table and Figure 2. If necessary, closer spacing should be used.

Direct outfall of each slope breaker to a stable, well-vegetated area and position to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

Table 2
Slope Breaker Spacing

<table>
<thead>
<tr>
<th>Percent Slope</th>
<th>Spacing (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-15</td>
<td>300</td>
</tr>
<tr>
<td>&gt; 15-30</td>
<td>200</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 2
Slope Breaker Diagram
1.3.5 Directional Tracking and Tillage

Directional tracking involves driving a tracked vehicle up and down a slope, creating horizontal grooves and ridges, which slows sheet runoff and helps to prevent rills from forming.\(^\text{18}\) This process, although it seems nominal, assists in preventing erosion along slopes.

Use directional tracking on all applicable projects.

1.3.6 Soil Binders

Soil binding is a process applying and maintaining polymeric lignin sulfonate soil stabilizers or emulsions materials to the soil surface to temporarily prevent water-induced erosion of exposed soils on construction sites. Soil binders typically provide dust, wind, and soil stabilization (erosion control) benefits in conditions where the Contractor cannot contain or curtail wind erosion (Fact Sheet 3).

Use soil binders on all applicable projects where the use of conventional dust control methods prove unsuccessful.

1.3.7 Streambank Stabilization

Streambank stabilization is a vegetative or mechanical method of preventing erosion or deterioration of the banks of waterways\(^\text{19}\). Stream stability is an active process, and while streambank erosion is a natural part of this process, we have often accelerated this erosion by altering the stream system.\(^\text{20}\)

Refer to BMPs previously discussed for ways to address erosion control and sediment control as most if not all are applicable. In addition, review Fact Sheet 4 for more information or ideas. Practices that stand out are as follows:

---


Preservation of existing vegetation
Mulch, blankets, and mats
Riprap armoring
Biologs and tree revetment
Hydroseeding

Advantages of installing streambank stabilization practices are as follows21:

- Stabilizes eroding banks and reduces downstream sedimentation.
- Low cost, in terms of materials, installation, and maintenance.
- Can be installed at any time when water levels are low enough to allow construction (willow posts are installed when they are dormant).
- Enhances self-establishment of native vegetation in a very short time after construction. Vegetation can be added at the next planting season using willow posts, grasses, or other suitable vegetation.
- Will enhance or improve aquatic habitat by increasing diversity.
- Provides for minimal disturbance of existing vegetation on the streambank.

---

21 University of Illinois at Urbana Champaign. *Streambank Stabilization in Illinois.*
## 1.4 SEDIMENT CONTROL

### 1.4.1 Silt Fence

Silt fence consists of geotextile fabric attached to support posts that are entrenched into the ground and are designed to serve as a temporary barrier to retain sediment on construction sites.

Place silt fence around staging areas, stockpiles, and trees to protect from damage. In addition, place silt fence at the downstream side of access roads to protect streams and ditches. Silt fence shall be either machine-sliced or hand-installed into the soil (Detail Sheet 3). Hand-installed silt fence shall have edges buried or weighted down by sand bags (Fact Sheet 5).

### 1.4.2 Silt Curtains

Silt curtains, similar to silt fence, are a temporary barrier of geotextile material used to contain sediments within a defined zone in the aquatic environment. Silt curtains are used when construction occurs in a water body, along a stream bank, or shoreline to prevent sediment stirred up during construction from migrating out of the work area and into the rest of the water body.

Place silt curtains at the perimeter of a project site in a river or pond to localize sediment release. In rivers and streams, silt curtains must be placed parallel to the flow direction in rivers or streams (Detail Sheet ).

---


NOTES:
1. CURTAIN 1 FT. FROM BOTTOM.
2. 100 FT. MAX. SPACING BETWEEN ANCHORS, MIN. 40 LBS.
3. USE ENOUGH ANCHORS TO HOLD SILT CURTAIN IN PLACE.
4. THE DEPTH OF THE SILT CURTAIN VARIES.
5. SILT CURTAIN HEIGHTS INCLUDES MAXIMUM WAVE HEIGHT FOR WATER BODY.
6. SILT CURTAIN, ROCK BERM OR SHEET PILE AS REQUIRED TO CONTROL THE INFILTRATION OF SILT.
7. KEEP AS CLOSE TO WORK AREA AS POSSIBLE.
8. FOR CONTAINING OVERFLOWS FROM WEIRS, STANDPIPES, SETTLING PONDS.
1.4.3 Sediment Barriers

A sediment barrier is a series of straw bales, silt fence, or sand bags placed on a level contour to intercept sheet flows and slow sheet flow runoff. Sediment barriers reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. When working adjacent to a wetland, straw bales are effective along approach slopes.

Construct sediment barriers, as needed, for the transmission maintenance and projects (Fact Sheet 7).

1.4.4 Sediment Traps

A sediment trap is a small temporary ponding area, usually with a gravel outlet, which collects and stores sediment from sites cleared or graded during construction. Sediment traps are formed by excavation or by construction of an earthen embankment. Sediment traps are a temporary measure with a design life of approximately 6 months to 1 year and are maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Control of surface water and groundwater may be important on some projects. When necessary, divert surface water around or through the construction site by pumps. Water collected in excavations will need removal. Direct discharge from these dewatering operations to a temporary sediment trap constructed with a spillway that consists of

---


geotextile fabric and crushed rocks. Construct sediment traps, as needed, at transmission pole sites and substation/maintenance facilities for dewatering activities (Fact Sheet 8).

1.4.5 Fiber Rolls

A fiber roll consists of wood excelsior, rice, wheat straw, or coconut fibers that are rolled or bound into a tight tubular roll and placed on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. The rolls also help to dissipate wave energy and trap eroded sediments, thereby providing a protected zone (for aquatic emergent vegetation) along the shoreline.

Fiber rolls are biodegradable, breaking down in 5 to 7 years. In that time, introduced native vegetation shall become established and provide long-term slope, shoreline, and bluff stabilization.

Fiber rolls will be used in conjunction with or instead of silt fence, bale checks, or sand bags on all slopes or in areas identified by the Project Manager (Fact Sheet 9 and Detail Sheet).

1.4.6 Check Dams

Check dams are made of rocks, straw, logs, lumber, or interlocking pre-cast concrete blocks within a ditch, drainage, swale, or channel to reduce the gradient of a ditch, thus slowing the water, lowering its ability to cause erosion, and allowing sediment to settle out.

Use check dams on construction sites in areas identified above when specified by the Project Manager or as warranted in the field (Fact Sheet 10).

---


FIBERROLL DITCH CHECK
USED ON ROUGH GRADED AREAS

CATEGORY 3
EROSION CONTROL BLANKET
EMBED UPSTREAM END
OR BLANKET AT LEAST 8"

STRAW OR WOOD FIBER
6"-7" DIA. ROLL ENCLOSED IN
PLASTIC OR POLYESTER NETTING

FIBER ROLL BLANKET SYSTEM DITCH CHECK

0.5" x 2" x 16" LONG WOODEN STAKES AT
1'0" SPACING MAXIMUM. STAKES SHALL BE
DRIVEN THROUGH THE BACK HALF OF THE
FIBER ROLL AT AN ANGLE OF 45 DEGREES WITH
THE TOP OF THE STAKE POINTING UPSTREAM.

FIBER ROLL STAKING DETAIL

NOTES:
1. POINT "A" TO BE AT LEAST 6" HIGHER THAN POINT "B"
1.4.7 Inlet Protection

Inlet protection consist of a sediment filter or an impounding area around or upstream of inlets, which temporarily stops pond runoff before it enters the inlet. This mechanism allows sediment to settle out of the storm water runoff (Detail Sheet).

Inlet protection will be used in areas identified by the Project Manager and/or when an inlet is discovered in the field.

1.4.8 Street Cleaning

Cleaning tracked sediments and debris for paved streets prevents unwanted material from washing into surface waters and improves the appearance of public roadways (Fact Sheet 10).

Paved roadways adjacent to construction or maintenance sites will be inspected at the end of each day and tracked soil shall be promptly removed.

1.4.9 Vegetative Buffer

A vegetative buffer strip, commonly referred to as filter strip, is a gently sloping area of vegetative cover that runoff water flows through before entering a stream, storm sewer, or other conveyance, which acts as living sediment filters that intercept and detain stormwater runoff. They reduce flow and velocity of surface runoff, promote infiltration, and reduce pollutant discharge by capturing and holding sediments and other pollutants carried in the runoff water.\(^{31}\)

Existing vegetation will be preserved as discussed in Section 1.3.1 and used as buffer strips where specified by the Project Manager or deemed appropriate in the field.

---

SILT FENCE RING ROCK BARRIER COMBINATION

NOTE:
1. ALL GEOTEXTILE USED FOR INLET PROTECTION SHALL BE MONOFILAMENT IN BOTH DIRECTIONS.
2. MACHINE SLICED SILT FENCE MAY BE SUBSTITUTED AT CULVERT INLETS AND AT DRAINS WHERE SITE CONDITIONS ALLOW.
3. USE WHERE INLET DRAINS IN AN AREA WITH SLOPES AT 1H:3V OR LESS.
ENDS SECURELY CLOSED TO PREVENT LOSS OF OPEN GRADED AGGREGATE FILL SECURED WITH 50 PSI ZIP TIE

4' LONG AND 6" DIAMETER GEOTEXTILE SOCK.
SEAM JOINED BY TWO ROWS OF STITCHING WITH A PLASTIC MESH BACKING OR HEATBONDED.
(OR APPROVED EQUIVALENT)
FILL ROCK LOG WITH OPEN GRADED AGGREGATE CONSISTING OF SOUND, DURABLE PARTICLES OF CRUSHED QUARRY ROCK OR GRAVEL CONFORMING TO 3137, CA-3 GRADATION (OR EQUIVALENT)

STORM DRAIN WITH ROCK LOG
1.4.10 Construction Entrance and Exit

A stabilized construction access is defined by a point of entrance or exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Construct entrances and exits by overlaying a 12-ounce geotextile fabric with a 6-inch layer of 1-to-3 inch diameter washed aggregate or woodchips. Vegetation and topsoil should be removed from the shoulder zones to construct the entrances, however, tall vegetation may be mowed. If the entrance/exit begins to rut, stabilize by placing a geogrid and additional washed aggregate or woodchips in the roadway. Remove the entrance/exit restore the area to the geometry of the intersection at the end of each project. Areas outside of the permanent roadway shoulder may require re-grading. Compacted soils shall be loosened by ripping or disking, then seeded and mulched (Fact Sheet 11).

Use construction entrance and exit on all construction or maintenance projects involving land disturbing activities adjacent to paved roadways.

1.4.11 Dust Control

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities.

Use water when dust proves to be a nuisance on project sites. If water proves ineffective, use soil binders (Section 1.3.6) (Fact Sheet 12).
PUBLIC ROAD

6" MIN. DEPTH OF 1" TO 3" CRUSHED ROCK OR WOOD CHIPS/SLASH MULCH

RADIUS AS REQUIRED

50' MIN.

NON-WOVEN GEOTEXTILE IF RUTTING OCCURS

ENTRANCE WIDTH AS REQUIRED

PREPARED BY

CONSTRUCTION ENTRANCE & EXIT

DATE

JULY 2006

DRAWN BY: EMEXHAIL
CHECKED BY: DYOUNG

FILE:

FIGURE

SEC - ##
1.5 VEGETATIVE STABILIZATION

Vegetation stabilization is a combination of preserving existing vegetation, discussed previously in Section 1.3.1, and the establishment of new vegetation or turf. Vegetative stabilization can prevent erosion by wind and water and improve wildlife habitat and aesthetics.\(^{32}\) In addition, vegetation reduces velocity and volume of stormwater runoff and protects exposed soil from the erosion forces of raindrops.

Most, if not all, construction projects contain some measure of clearing vegetation. Traditionally, sites are cleared of vegetation in preparation for construction activities. More vegetation is often removed than is necessary, which leads to a greater amount of exposed soil that is prone to erosion. To prevent or minimize the exposure of soil to erosion, it is important to protect and preserve existing vegetation and put a plan in place to establish temporary and permanent vegetation.

Temporary seeding is a means of growing a short-term (less than 5 years) vegetative cover to temporarily stabilize denuded areas that may be in danger of erosion.\(^{33}\) Temporary seeding controls runoff and erosion, provides residue for soil protection and seedbed preparation, and reduces problems of mud and dust production from bare soil surfaces during construction on areas that will not be brought to final grade for a period of more than 14 working days. These plantings consist of rapidly growing annual grasses, small grains, or legumes.\(^{34}\) Temporary seeding is applicable to areas, which require temporary stabilization for a period of 1 to 5 years.

Permanent seeding is a means of establishing permanent, perennial vegetative cover on disturbed areas to prevent erosion, remove sediment from runoff, reduce the volume of runoff, and improve water quality.\(^{35}\) Permanent seeding is well-suited in areas where permanent, long-lived vegetative cover is the most practical or most effective method of stabilizing the soil.\(^{36}\)

---


All construction sites shall be brought to permanent stabilization with the use of permanent seeding provided herein or with sod. No site shall be left physically disturbed at the completion of construction or maintenance projects.

In this section, information specific to states that Dairyland services have been provided. The information includes the following: soil characteristics, temporary and permanent seeding recommendations, sodding, and required vegetative maintenance and local seed vendors (Fact Sheet 1).

Seeding recommendations provided herein for Illinois and Minnesota were taken from the DOT in those respective states. The information for Iowa and Wisconsin was taken from their respective Department of Natural Resources (DNR).

1.5.1 Illinois

1.5.1.1 Soil Characteristics

Dairyland’s entire service area in Illinois, as shown on Figure 3, consists of highly erodible soil. Projects undertaken in these areas will require substantial amounts of time dedicated to two essential components of project planning: scheduling and site preparation. If at all possible, projects in these areas should be undertaken during winter months when the ground is frozen or at times during the year when precipitation events are low, for instance, fall months.

1.5.1.2 Temporary Seeding

1. Seeding Mixture

Class 7 or temporary turf cover mixture is recommended for temporary turf establishment. 37

Class 7 temporary turf cover mixture consists of:

- Perennial Ryegrass – 50 lbs per acre
- Oats, Spring – 64 lbs per acre

Class 7 mixture can be applied at any time prior to applying any seeding class or added to them and applied at the same time. Other seeds may be used if approved by the Project Manager.

2. Seedbed Preparation

Seedbed preparation is not required if the soil is in loose condition. 38 However, if the soil is hard or caked, light disking is required.


3. **Seeding Method**

Sow seedings with a hydraulic seeder or rangeland type grass drill. Broadcasting or hydraulic seeding is allowed on steep slopes (over 1:3 [V:H]) or inaccessible areas where use of the equipment specified is physically impossible. Hand broadcasting or other approved methods are permitted in the instance when Class 7 is used as an erosion control measure to establish temporary cover. Sufficient water is required to wash seeds down to the soil.

---

### 1.5.1.3 PERMANENT SEEDING

#### 1. SEEDING MIXTURE

<table>
<thead>
<tr>
<th>Class –Type</th>
<th>Seeds</th>
<th>Kg/Hectare (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Mixture</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
<td>Ky Bluegrass Perennial Ryegrass Creeping Red Fescue</td>
<td>110 (100) 70 (60) 50 (40)</td>
</tr>
<tr>
<td><strong>Salt Tolerant Lawn Mixture</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
<td>Bluegrass Perennial Ryegrass Dawsons Red Fescue Scaldis Hard Fescue Fults Salt Grass</td>
<td>70 (60) 20 (20) 20 (20) 20 (20) 70 (60)</td>
</tr>
<tr>
<td><strong>Low Maintenance Lawn Mixture</strong></td>
<td>Fine Leaf Turf – Type Fescue&lt;sup&gt;3&lt;/sup&gt; Perennial Ryegrass Red Top Creeping Red Fescue</td>
<td>170 (150) 20 (20) 10 (10) 25 (20)</td>
</tr>
<tr>
<td><strong>Roadside Mixture</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
<td>Alta Fescue or Ky 31 Perennial Ryegrass Creeping Red Fescue Fults Salt Grass&lt;sup&gt;1&lt;/sup&gt;</td>
<td>110 (100) 55 (50) 50 (40) 10 (10)</td>
</tr>
<tr>
<td><strong>Salt Tolerant Roadside Mixture</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
<td>Alta Fescue or Ky 31 Perennial Ryegrass Dawsons Red Fescue Scaldis Hard Fescue Fults Salt Grass&lt;sup&gt;1&lt;/sup&gt;</td>
<td>45 (40) 25 (20) 5 (5) 20 (30) 70 (60)</td>
</tr>
<tr>
<td><strong>Slope Mixture</strong>&lt;sup&gt;7&lt;/sup&gt;</td>
<td>Alta Fescue of Ky 31 Perennial Ryegrass Alsike Clover&lt;sup&gt;2&lt;/sup&gt; Birdsfoot Trefoil&lt;sup&gt;2&lt;/sup&gt; Little Bluestem Side-Oats Grama Oats, Spring</td>
<td>45 (40) 25 (20) 5 (5) 10 (10) 55 (50)</td>
</tr>
<tr>
<td><strong>Native Grass&lt;sup&gt;4,6&lt;/sup&gt;</strong></td>
<td>Big Bluestem Little Blue Stem Side-Oats Grama Wild Rye Switch Grass Indian Grass Annual Ryegrass Oats, Spring Perennial Ryegrass</td>
<td>4 (4) 5 (5) 5 (5) 1 (1) 1 (1) 2 (2) 30 (25) 30 (25) 15 (15)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class –Type</th>
<th>Seeds</th>
<th>Kg/Hectare (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Profile Native Grass&lt;sup&gt;6,8&lt;/sup&gt;</td>
<td>Little Blue Stem</td>
<td>5 (5)</td>
</tr>
<tr>
<td></td>
<td>Side-Oats Grama</td>
<td>5 (5)</td>
</tr>
<tr>
<td></td>
<td>Wild Rye</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>Prairie Dropseed</td>
<td>0.5 (0.5)</td>
</tr>
<tr>
<td></td>
<td>Annual Ryegrass</td>
<td>30 (25)</td>
</tr>
<tr>
<td></td>
<td>Oats, Spring</td>
<td>30 (25)</td>
</tr>
<tr>
<td></td>
<td>Perennial Ryegrass</td>
<td>15 (15)</td>
</tr>
<tr>
<td>Wetland Grass and Sedge Mixture&lt;sup&gt;6,8&lt;/sup&gt;</td>
<td>Annual Ryegrass</td>
<td>30 (25)</td>
</tr>
<tr>
<td></td>
<td>Oats, Spring</td>
<td>30 (25)</td>
</tr>
<tr>
<td></td>
<td>Wetland Grasses&lt;sup&gt;41&lt;/sup&gt;</td>
<td>6 (6)</td>
</tr>
<tr>
<td>Forb With Annuals Mixture</td>
<td>Annuals Mixture&lt;sup&gt;37, 6, 8&lt;/sup&gt;</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>Forb Mixture&lt;sup&gt;37, 6, 8&lt;/sup&gt;</td>
<td>10 (10)</td>
</tr>
<tr>
<td>Large Flower Native Forb Mixture&lt;sup&gt;6,8&lt;/sup&gt;</td>
<td>Forb Mixture 6, 8</td>
<td>5 (5)</td>
</tr>
<tr>
<td>Wetland Forb</td>
<td>Forb Mixture&lt;sup&gt;37, 6, 8&lt;/sup&gt;</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Conservation Mixture</td>
<td>Smooth Brome Grass</td>
<td>45 (40)</td>
</tr>
<tr>
<td></td>
<td>Vernal Affairs&lt;sup&gt;2&lt;/sup&gt;</td>
<td>15 (15)</td>
</tr>
<tr>
<td></td>
<td>Oats, Spring</td>
<td>55 (48)</td>
</tr>
<tr>
<td>Salt Tolerant Conservation Mixture</td>
<td>Smooth Brome Grass</td>
<td>45 (40)</td>
</tr>
<tr>
<td></td>
<td>Vernal Alfalfa&lt;sup&gt;2&lt;/sup&gt;</td>
<td>15 (15)</td>
</tr>
<tr>
<td></td>
<td>Oats, Spring</td>
<td>55 (48)</td>
</tr>
<tr>
<td></td>
<td>Fults Salt Grass&lt;sup&gt;7&lt;/sup&gt;</td>
<td>25 (20)</td>
</tr>
</tbody>
</table>

<sup>1</sup>Fults pucinnellia distans  
<sup>2</sup>Legumes – inoculation required  
<sup>3</sup>Specific variety as shown in the plans or approved by the Project Manager  
<sup>4</sup>Other seeds may be used if approved by the Project Manager  
<sup>5</sup>PLS = Pure Live Seed to be used  
<sup>6</sup>Fertilizer not required  
<sup>7</sup>Planting times April 1<sup>st</sup> to June 1<sup>st</sup> and August 15<sup>th</sup> to September 30<sup>th</sup>  
<sup>8</sup>Planting times May 15<sup>th</sup> to June 30<sup>th</sup> and October 15<sup>th</sup> to December 1<sup>st</sup>  

### 2. SEEDBED PREPARATION

For bare-earth seeding, do not start seedbed preparation until all stones, boulders, debris, and similar material larger than 75 mm (3 inches) in diameter have been removed. Work the area to be seeded to a minimum depth of 75 mm (3 inches) with a disk tiller or other equipment (approved by the Project Manager) reducing all soil particles to a size not larger than 50 mm (2 inches) in the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting, and caking. No seeds shall be sown until the Project Manager has approved the seedbed.

---

3. **SEEDING METHOD**

**Bare Earth Seeding**

Bare earth seeding shall be done using the following methods unless otherwise specified or directed by the Project Manager:

1. Sow seed Classes 1, 2, and 6 with a machine that mechanically places the seed in direct contact with the soil, packs, and covers the seed in one continuous operation.
2. Sow seed Class 3 with a hydraulic seeder.
3. Sow seed Class 4 with a rangeland type grass drill.
4. Sow seed Class 5 with a hydraulic seeder or rangeland type grass drill. Broadcasting or hydraulic seeding will be allowed as approved by the Project Manager on steep slopes (over 1:3 [V:H]) or in inaccessible areas where use of the equipment specified is physically impossible.

**Interseeding**

Interseeding is the seeding of areas of existing turf. Prior to interseeding, all areas of existing turf to be interseeded, except as listed below, shall be mowed one or more times to a height of not more than 75 mm (3 inches). The equipment used shall be capable of completely severing all growth at the cutting height and distributing it evenly over the mowed area.

The cut material shall not be windrowed or left in a lumpy or bunched condition. Additional mowing may be required, as directed by the Project Manager, on certain areas in order to disperse the mowed material and allow penetration of the seed. The Contractor will not be required to mow within 300 mm (1 foot) of the ROW fence, continuously wet ditches and drainage ways, slopes 1:3 (V:H) and greater, or areas which may be designated as not mowable by the Project Manager. Debris encountered during the mowing and interseeding operations, which hamper the operation or are visible from the roadway shall be removed and disposed of according to the seedbed preparation portion of Section 1.5.1.3. Damage to the ROW fence and turf, such as ruts or wheel tracks more than 50 mm (2 inches) in depth, shall be repaired to the satisfaction of the Project Manager prior to the time of interseeding. All seeding classes shall be interseeded using a rangeland type grass drill with an interseeding attachment, except:

1. When specified in the plans or directed by the Project Manager, a slit seeder shall be used to interseed Class 1 or Class 2 seed.
2. Broadcasting or hydraulic seeding will be allowed, as approved by the Project Manager, on steep slopes (1:3 [V:H] or steeper) or in inaccessible areas where use of the equipment specified is physically impossible. Apply sufficient water to these areas to wash the seed down to the soil.
1.5.2 Iowa

1.5.2.1 Soil Characteristics

A large portion of Dairyland service area within Iowa does not have available data. Available erodible soils data for Dairyland’s service area in Iowa only cover approximately 40 percent of the total area as shown on Figure 4. Of the available data, the area consists predominantly of potentially highly erodible soils which are located in the eastern part of the service area. In the central part of the service area, the soils contain a low erodibility factor. Given the potential for these soils to become highly erodible, projects undertaken in these areas will require considerable amount of time dedicated to two essential components of project planning: scheduling and site preparation.

1.5.2.2 Temporary Seeding

1. Seed Mixture

Table 4

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Application Rate (lbs/acre)</th>
<th>Planting Season</th>
<th>Seeding Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial Ryegrass</td>
<td>40 (1lb/1,000 sq. feet)</td>
<td>All</td>
<td>Hand broadcasting or hydroseeding</td>
</tr>
<tr>
<td>Oats</td>
<td>48 (1.2 lbs/1,000 sq ft.)</td>
<td>Plant March 1 – May 20</td>
<td></td>
</tr>
<tr>
<td>Sundangrass</td>
<td>35 (0.8 lbs/1,000 sq ft.)</td>
<td>Plant May 21 – Aug. 14</td>
<td></td>
</tr>
<tr>
<td>Winter Rye</td>
<td>64 (1.6 lbs/100 sq ft.)</td>
<td>Plant Aug. 15 – Sept. 30</td>
<td></td>
</tr>
</tbody>
</table>

2. Seedbed Preparation

Prepare seedbed to a depth of 3 inches. Before final preparation, apply 400 lbs of 13-13-13 (nitrogen-phosphorous-potassium [NPK]) fertilizer per acre (10 lbs/1,000 sq ft) and incorporate it into the seedbed. Roll the area to be seeded with an approved cultipacker.

Note: Phosphorus-free Fertilizer may be required in some areas.
1.5.2.3 PERMANENT SEEDING

1. SEED MIXTURE

Table 5
Iowa Permanent Seed Mixture

<table>
<thead>
<tr>
<th>Type</th>
<th>Percent</th>
<th>Seeding Method</th>
<th>Maintenance and Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawn Grass Mixture, 80 lbs/ac (2 lbs/1,000 sq ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bluegrass</td>
<td>60</td>
<td>Hand broadcasting or hydroseeding</td>
<td>- Inspect once monthly, noting stand of grass</td>
</tr>
<tr>
<td>Perennial Ryegrass</td>
<td>20</td>
<td></td>
<td>- Look for rills formed by stormwater runoff or where lack of moisture caused seedlings to die</td>
</tr>
<tr>
<td>Creeping Red Fescue</td>
<td>15</td>
<td></td>
<td>- All areas should be corrected</td>
</tr>
<tr>
<td>White Dutch Clover</td>
<td>&gt;5</td>
<td></td>
<td>It may be necessary to re-prepare the seedbed and re-mulch</td>
</tr>
<tr>
<td>Tall Grass Mixture, 40 lbs/ac (1 lb/1,000 sq ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ky 31 Fescus</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switchgrass</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromegrass</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alsike Clover</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. SEEDBED PREPARATION

Prepare seedbed to a depth of 75 mm (3 inches). Before final preparation, apply 700 lbs of 13-13-13 NPK fertilizer per acre (12 lbs/1,000 sq ft) and incorporate it into the seedbed. Roll the area to be seeded with an approved cultipacker.

Note: phosphorus free fertilizers may be required in some areas.

1.5.3 Minnesota

1.5.3.1 SOIL CHARACTERISTICS

A sizable portion of Dairyland service area within Minnesota does not have available data. Available erodible soils data for Dairyland’s service area in Minnesota covers approximately 65 percent of total area as shown on Figure 5. Of the available data, the area consists predominantly of highly erodible soils in the eastern and central part of the service area and soils with low erodibility factor located in the western part of the service area. Projects undertaken in areas...
with highly erodible soils will require substantial amounts of time dedicated to two essential components of project planning: scheduling and site preparation. If at all possible, projects in these areas should be undertaken during winter months when the ground is frozen or times during the year when precipitation events are low, for instance, fall months.
1.5.3.2 **Temporary Seeding**

1. **Seed Mixture**

   Table 6

   **Minnesota Temporary Seed Mixture**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Mixture</th>
<th>Application Rate (lbs/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Cover</td>
<td>100B</td>
<td>100</td>
</tr>
<tr>
<td>Spring/Summer Cover</td>
<td>110B</td>
<td>100</td>
</tr>
<tr>
<td>1 to 2 years of Cover*</td>
<td>150</td>
<td>40</td>
</tr>
<tr>
<td>2 to 5 years of Cover</td>
<td>190</td>
<td>60</td>
</tr>
</tbody>
</table>

   *Specified for this region per Minnesota DOT Technical Memo dated November 2005.

   Table 7

   **Minnesota Mixture 150**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Bulk Rate (lbs/ac-kg/ha)</th>
<th>Percent of Mix Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye-grass, perennial</td>
<td>15 -16.8</td>
<td>37.5</td>
</tr>
<tr>
<td>Wheat-grass, slender</td>
<td>5 - 5.6</td>
<td>12.5</td>
</tr>
<tr>
<td>Red clover</td>
<td>10 -11.2</td>
<td>25.0</td>
</tr>
<tr>
<td>Alfalfa, vernal</td>
<td>10 -11.2</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>40 -44.8</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

2. **Seedbed Preparation**

   Seedbed preparations and fertilizer recommendation are covered in the next section: Seeding Methods.

   Lime should be specified for all projects with a subsoil pH of 6.2 and/or less, at a rate of 2 tons per acre.

---

42 Minnesota Department of Transportation. Memo from Lori Belz, Natural Resource Program Manager to Greg Paulson, Office of Environmental Services, District 6 ADE, Program Delivery. November 2005.
3. **SEEDING METHODS**

**Method 1 – Drop Seeding**

Drop seeding on tilled sites is the standard method for seeding on prepared construction projects.

1. **Site Preparation** – Prepare the site by loosening topsoil to a minimum depth of 75 mm (3 inches).
2. **Fertilizer** – Either use a fertilizer analysis based on a soil test or a general recommendation of a 24-12-24 NPK commercial grade analysis at 300 lbs per acre.
3. **Seed Application** – Apply seed with a drop seeder that will accurately meter the types of seed to be planted, keep all seeds uniformly mixed during the seeding, and contain drop seed tubes for seed placement (Brillion-type). The drop seeder should be equipped with a cultipacker assembly to ensure seed-to-soil contact.
4. **Seeding Rates** – Rates are specified in the mixture tabulation for the specified mix.
5. **Packing** – If the drop seeder is not equipped with a cultipacker, the site should be cultipacked following the seeding to ensure seed-to-soil contact.
6. **Mulch** – Mulched and disc-anchor the site following cultipacking. The standard mulch is Minnesota DOT Type 1 at a rate of 2 tons per acre.

**Method 2 – Hydroseeding**

Hydroseeding is an acceptable method for establishing the general mixtures when done correctly. However, it is imperative that the site is prepared and finished properly. Minnesota DOT generally uses hydroseeding on steep slopes or other areas inaccessible to a drop seeder, such as wetland edges and ponds. Hydroseeding is not recommended if the extended weather patterns are hot and dry and the soil surface is dry and dusty. The seed-water slurry should be applied within 1 hour after the seed is added to the hydroseeder tank.

1. **Site Preparation** – Prepare the site by loosening topsoil to a minimum depth of 3 inches. It is critical that the seedbed be loosened to a point that there are a lot of spaces for seed to filter into cracks and crevices, otherwise, it may end up on the surface and wash away with the first heavy rain.
2. **Fertilizer** – Either use a fertilizer analysis based on a soil test or a general recommendation of a 24-12-24 NPK commercial grade analysis at 300 lbs per acre.
3. **Seed Application** – Apply seed by hydroseeding it evenly over the entire site. A fan-type nozzle should be used with approximately 500 gallons of water per acre. It is recommended to add approximately 75 lbs of hydromulch per 500 gallons of water for a visual tracer to ensure uniform coverage.
4. **Seeding Rates** – Rates are specified in the mixture tabulation for the specified mix.
5. **Harrowing** – The site should be harrowed, cultipacked, or raked following seeding.

6. **Mulch** – Mulch the site following harrowing using one of the following methods (as per plans):
   - Minnesota DOT Type 1 mulch at a rate of 2 tons per acre with disc anchoring
   - Minnesota DOT Hydraulic Soil Stabilizer or Bonded Fiber Matrix (BFM) on inaccessible sites

   **Note:** When seeding in conjunction with a hydraulic soil stabilizer (BFM's), hydro-mulches, etc., it is recommended that a two-step operation be used. Seed should be placed first and the hydraulic soil stabilizer be applied afterwards. This is to ensure that seed comes into direct contact with the soil.

**Method 3 – Broadcast Seeding**

Broadcast seeding is performed either with mechanical “cyclone” seeders, by hand seeding, or by any other method that scatters seed over the soil surface. It is essential that steps be taken to ensure good seed-to-soil contact when broadcast seeding is used.

1. **Site Preparation** – Prepare the site by loosening topsoil to a minimum depth of 3 inches. It is critical that the seedbed be loosened to a point that there are spaces for seed to filter into cracks and crevices, otherwise, it may end up on the surface and wash away with the first heavy rain.

2. **Fertilizer** – Either use a fertilizer analysis based on a soil test or a general recommendation of a 24-12-24 NPK commercial grade analysis at 300 lbs per acre.

3. **Seed Application** – Apply seed by broadcasting it evenly over the entire site. Several types and sizes of broadcast seeders are available for use, ranging from fertilizer-type spreaders to power spreaders mounted on all terrain vehicles. Seed should be mixed thoroughly prior to seeding and should be mixed occasionally in the spreader to prevent separation and settling.

4. **Seeding Rates** – Rates are specified in the mixture tabulation for the specified mix.

5. **Harrowing** – The site should be harrowed or raked following seeding.

6. **Packing** – The site should be cultipacked following harrowing.

7. **Mulch** – Mulch the site following packing using one of the following types of mulch (as per plans or special provisions):
   - Minnesota DOT Type 1 mulch at a rate of 2 tons per acre followed by disc anchoring
   - Minnesota DOT Hydraulic Soil Stabilizer or BFM on inaccessible sites
Method 4 – Interseeding

Interseeding into existing vegetation or mulch is generally used for sites that did not establish well or if a temporary mulch was applied to the site. An interseeder drill can be used to plant the seed without removing or tilling the existing vegetation or mulch.

1. **Site Preparation for Existing Vegetation** – Prepare the site by mowing existing vegetation to a height of 4 to 6 inches. The area can then be directly planted using an interseeding drill.

   *NOTE:* Sites that contain significant weed infestations may require weed control measures before planting. After mowing, a herbicide application with glyphosate should be used. Addition of a surfactant and/or addition of two, 4-D to the mix often results in a more complete kill, especially with unwanted broad-leaved species. Recommended herbicide rates are 2 quarts per acre of glyphosate and 1 to 2 quarts per acre 2, 4-D. Seeding can be performed 7 to 10 days after herbicide application. Other broadleaf herbicides can also be used, such as Trimec, Transline, Stinger, etc. Follow the label directions.

2. **Fertilizer** – Either use a fertilizer analysis based on a soil test or a general recommendation of a 24-12-24 NPK commercial grade analysis at 300 lbs per acre.

3. **Seed Application** – Apply the seed mixture with a seed drill that will accurately meter the seed to be planted and keep all seeds uniformly mixed during the drilling. The drill should contain a legume box for small seeds, and it should be equipped with disc furrow openers and packer assembly to compact the soil directly over the drill rows. Maximum row spacing should be 8 inches. The inter-seeder drill must be out-fitted with trash rippers that will slice through the vegetative mat and make a furrow into the underlying soil approximately 1 inch wide by 0.5 to 1 inches deep. These furrows shall be directly in line with the drill seed disc openers. Fine seed should be drop-seeded onto the ground surface from the fine seed box. Drill seeding should be done whenever possible at a right angle to surface drainage.

4. **Seeding Rates** – Rates are specified in the mixture tabulation for the specified mix.

5. **Harrowing** – Harrowing is not required when using this seeding method.

6. **Packing** – Cultipacking the site is recommended to ensure seed-to-soil contact.

7. **Mulch** – Mulch is not required when using this seeding method unless a 90 percent soil coverage rate is not maintained.
1.5.3.3 PERMANENT SEEDING

1. SEED MIXTURE

Table 8

Minnesota Permanent Seed Mixture

<table>
<thead>
<tr>
<th>Type</th>
<th>Purpose</th>
<th>Mixture</th>
<th>Seeding Rate (lbs/ac)</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Sandy Roadside</td>
<td>240</td>
<td>75</td>
<td>Mow up to 3 times per year</td>
</tr>
<tr>
<td>General</td>
<td>General Roadside</td>
<td>250</td>
<td>70</td>
<td>Mow up to 3 times per year</td>
</tr>
<tr>
<td>Commercial Turf</td>
<td></td>
<td>260</td>
<td>100</td>
<td>Mow a minimum of once per 2 weeks</td>
</tr>
<tr>
<td>Residential Turf</td>
<td></td>
<td>270</td>
<td>120</td>
<td>Mow a minimum of once per 2 weeks</td>
</tr>
<tr>
<td>Agricultural Area Roadside</td>
<td></td>
<td>280</td>
<td>50</td>
<td>Mow up to 3 times per year</td>
</tr>
<tr>
<td>Native</td>
<td>Ponds and Wet Area – Tall Grasses</td>
<td>310</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>Sandy/dry Areas – Short Grasses</td>
<td></td>
<td>330</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>Sandy/dry Areas – Mid-Height Grasses</td>
<td></td>
<td>340</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>General Roadside</td>
<td></td>
<td>350</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>Woodland Edges</td>
<td></td>
<td>5B</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Western Prairie – Tall Grasses</td>
<td></td>
<td>10B</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Sandy Prairie – Tall Grasses</td>
<td></td>
<td>20B</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Sedge Meadow</td>
<td></td>
<td>25B</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Floodplain</td>
<td></td>
<td>26B</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

To reduce weed establishment, mow 2 to 3 times (30 days apart) during the first year with the mower deck about 6 to 8 inches off the ground. Mow one time during the second year before weeds set their seeds. Burn or mow once every 3 to 5 years following the initial 2 years of maintenance to remove dead plant material and stimulate new seed.

2. SEEDBED PREPARATION

Fertilizer is best determined by a soil fertility test. If no soil fertility tests are taken, these general fertilizer recommendations may be followed:

Table 9
Minnesota General Fertilizer Recommendations

<table>
<thead>
<tr>
<th>Seed Mixture</th>
<th>Fertilizer</th>
<th>Application Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Seed</td>
<td>17-10-30</td>
<td>350 lbs/ac or 392 kg/ha</td>
</tr>
<tr>
<td>Turf Seed</td>
<td>22-5-10</td>
<td>300 lbs/ac or 336 kg/ha</td>
</tr>
<tr>
<td>Sod</td>
<td></td>
<td>150 lbs/ac or 118 kg/ha</td>
</tr>
</tbody>
</table>

3. **Seeding Methods**

Please refer to seeding methods in Section 0 of this manual.

1.5.4 **Wisconsin**

1.5.4.1 **Soil Characteristics**

A substantial portion of Dairyland service area within Wisconsin does not have available data. Available erodible soils data for Dairyland’s service area in Wisconsin covers approximately 50 percent of total area as shown on Figure 6. Of the available data, the area consists of highly erodible soils in the western and central part of the service area, soils with low erodibility factor located in the eastern and central part of the service area and potentially highly erodible soils throughout areas with available data. Projects undertaken in areas with highly erodible soils and soils which are potentially highly erodible will require substantial amounts of time dedicated to two essential components of project planning: scheduling and site preparation. If at all possible, projects in these areas should be undertaken during winter months when the ground is frozen or at times during the year when precipitation events are low, for instance, fall months.
1.5.4.2 TEMPORARY SEEDING

1. **SEED MIXTURE**

<table>
<thead>
<tr>
<th>Species</th>
<th>Lbs per Acre</th>
<th>Percent Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oats</td>
<td>131&lt;sup&gt;1&lt;/sup&gt;</td>
<td>98</td>
</tr>
<tr>
<td>Cereal Rye</td>
<td>131&lt;sup&gt;2&lt;/sup&gt;</td>
<td>97</td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>131&lt;sup&gt;2&lt;/sup&gt;</td>
<td>95</td>
</tr>
<tr>
<td>Annual Ryegrass</td>
<td>80&lt;sup&gt;2&lt;/sup&gt;</td>
<td>97</td>
</tr>
</tbody>
</table>

<sup>1</sup> *Spring and Summer Seeding*
<sup>2</sup> *Fall Seeding*

2. **SEEDBED PREPARATION**

Temporary seeding requires a seedbed of loose soil to a minimum depth of 2 inches.

Fertilizer application is not generally required for temporary seeding. However, any application of fertilizer or lime shall be based on soil testing results.

The soil shall have a pH range of 5.5 to 8.0.

3. **SEEDING METHOD**

All seeding methods including, but not limited to, broadcasting, drilled, or hydroseeding is acceptable, as appropriate for the site.

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### 1.5.4.3 PERMANENT SEEDING

#### 1. SEED MIXTURE

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Mixture</th>
<th>Seeding Rate</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use in areas with average loam, heavy clay, and moist soils predominate</td>
<td>10</td>
<td>1-1/2/1 lbs/1,000 sq ft</td>
<td>Protect seeded areas from traffic or other uses by warning signs. Repair surface gullies or other damage by re-grading and re-seeding. Mow and water as directed by seeding vendor.</td>
</tr>
<tr>
<td>Use in areas where light, dry, well-drained sandy or gravelly soils predominate. Use for all high cut and fill slopes exceeding 6 to 8 feet</td>
<td>20</td>
<td>3 lbs/1,000 sq ft</td>
<td></td>
</tr>
<tr>
<td>Salt – Tolerant areas – use in medians and on slopes or in ditches within 15 feet of the shoulder.</td>
<td>30</td>
<td>2 lbs/1,000 sq ft</td>
<td></td>
</tr>
<tr>
<td>Use in urban areas</td>
<td>40</td>
<td>2 lbs/1,000 sq ft</td>
<td></td>
</tr>
<tr>
<td>Use on very steep slopes where sterile soil and erosive conditions exist</td>
<td>50</td>
<td>1/2 lbs/1,000 sq ft</td>
<td></td>
</tr>
<tr>
<td>Use for cover in newly graded wet areas <em>(not wetlands)</em></td>
<td>60</td>
<td>1-1/2/1 lbs/1,000 sq ft (equivalent)</td>
<td></td>
</tr>
<tr>
<td>Use on slopes or upland area with well drained soils</td>
<td>70</td>
<td>3 lbs/1,000 sq ft (equivalent)</td>
<td></td>
</tr>
</tbody>
</table>
2. **SEEDBED PREPARATION**

Permanent seeding requires a seedbed of loose topsoil to a minimum depth of 100 mm (4 inches) with the ability to support a dense vegetative cover. Be sure to incorporate topsoil, which should have been segregated at the start of the project. Application rates of fertilizer or lime shall be based on soil testing results. Prepare a tilled, fine, but firm seedbed. Remove rocks, twigs, foreign material, and clods over 2 inches that cannot be broken down. The soil shall have a pH range of 5.5 to 8.0.

A fertilizer program should begin with a soil test. Soil tests provide specific fertilizer recommendations for the site and can help to avoid over-application.

3. **SEEDING METHOD**

Seeding methods including, but not limited to, broadcasting, drilled, or hydroteeing, are acceptable, as appropriate for the site.

1.5.5 **Sodding**

Sod is a grass turf and the part of the soil beneath it held together by roots or a piece of other material. Sod is used in areas where vegetation is required to prevent erosion and is deemed necessary by the Project Manager. Sod is often used as an alternate to permanent seeding for instant aesthetic value. It is important to note that in order for sod to survive, proper conditions must be present on the site, such as adequate watering.

1.5.6 **Local Seed Vendors**

**Iowa**

Ion Exchange, Inc  
1878 Old Mission Drive  
Harpers Ferry, IA  
(563) 535-7231

**Minnesota**

Brock White  
6784 10th Avenue Southwest  
Rochester, MN 55902  
(507) 282-2421 or (800) 279-9034

Shooting Star Native Seeds (Seed Only)  
20740 County Road 33  
Spring Grove, MN 55974  
(507) 498-3944
Sodko, Inc. (Sod Only)
20740 County Road 33
Spring Grove, MN 55974
(507) 498-3943

Ramy Turf Products
842 Vandalia Street
St. Paul, MN 55114
(651) 917-0939 or (800) 658-7269

Wisconsin
La Crosse Forage and Turf Seed Corporate
2541 Commerce Street
La Crosse, WI 54603
(608) 783-9560 or (800) 328-1909
1.6 STORMWATER TREATMENT

Stormwater treatment BMPs consist of infiltration systems, constructed wetlands, and retention and detention ponds. The following treatments should all be evaluated for pollution prevention and water quality benefits when building substations.

1.6.1 Infiltration Systems

Infiltration systems are stormwater runoff impoundments designed to capture stormwater runoff, hold the designed volume, and infiltrate it into the ground over the designed period. These systems include, but are not limited to, infiltration basins, rain gardens, and underground infiltration tank.

1.6.2 Constructed Wetland

A constructed wetland is an artificial marsh or swamp created for human use, such as habitat to attract wildlife, or for removing sediments and pollutants, such as heavy metals, from the water.\(^45\)

1.6.3 Retention and Detention Pond Systems

A retention pond is designed to hold a specific amount of water indefinitely. Usually the pond is designed to have drainage leading to another location when the water level gets above the pond capacity, but still maintains a certain capacity.\(^46\)

A detention pond is a low-lying area that is designed to temporarily hold a set amount of water while slowly draining to another location. They are more or less around for flood control when large amounts of rain could cause flash flooding if not dealt with properly.

Infiltration basins, constructed wetlands, and detention or retention ponds must be evaluated and selected based on water quality needs at the site.

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1.7 General Operations

1.7.1 Residential Areas

Construction near residential areas requires special precautions to minimize disturbance to residences and maximize safety considerations. Impacts to residences near construction will be minimized by implementing the following applicable mitigation measures:

- Strip and store, or replace topsoil with imported topsoil after construction.
- Install orange safety fence between the construction area and residences.
- Avoid removal of trees and landscape whenever possible or specified in an agreement.
- Maintain access to residences at all times during construction.
- Notify residences within 48 hours of start of construction and construction during nighttime hours. Review permits for additional requirements for nighttime construction.

Restoration of residential areas must be initiated within 24 hours of completion of construction. All disturbed areas must be graded to pre-construction contours. Topsoil (either segregated and replaced, or newly imported) must be placed and raked smooth. The disturbed areas must be reseeded or resodded according to landowner requests. All ornamental shrubs and other landscaping must be restored in accordance with the landowner’s request, or compensate the landowner in an agreed amount or replace damaged landscaping. Restoration work should be performed by a contractor or Dairyland personnel familiar with local horticultural and turf establishment practices.

Refer to BMPs previously discussed for erosion control and sediment control, as they are applicable in residential environments.

1.7.2 Highway and Road Crossings

Roadway crossing and ROW access points must be identified before the start of construction to maintain safe and accessible conditions throughout construction.

Refer to BMPs previously discussed for erosion control and sediment control as most if not all are applicable. A few that stand out are as follows:

- Preservation of existing vegetation
- Mulch, blankets, and mats
- Silt fence along perimeter of project area adjacent to roadway
- Construction entrance and exits
- Street cleaning

Don’t forget!
Erosion control is generally more cost-effective than sediment control and requires less maintenance and repair.
1.7.2.1 MAINTENANCE

Roadway crossings should be maintained in a condition which will prevent tracking of sediment onto the roadway. Mud tracked onto paved roadways must be shoveled or swept off the road daily.

1.7.3 Wetland Crossings

A wetland is a land inclusion that has a predominance of hydric soils that are saturated or flooded for long parts of the growing season and that supports a hydrophytic vegetation under the above conditions.

Permits are required to construct or work in wetlands. Refer to Volume II for more information.

Every effort should be made to avoid crossing wetlands, however, in some instances, it is not possible. In those instances, minimize construction to preserve wetland characteristics. Clearing and grading within wetlands must be limited to topsoil segregation and enhancing natural revegetation. To preserve wetland hydrology, minimize construction activities in wetlands or use special construction techniques to reduce soil compaction.

The procedures in this section require that judgment be applied in the field and must be implemented under the supervision of the Contractor. Non-compliance with these procedures must be reported for corrective action.

1.7.3.1 TIME WINDOWS FOR CONSTRUCTION

Transmission line and substation construction or maintenance activities cannot occur in wetland areas when restricted by appropriate federal or state permits due to wildlife mating or breeding seasons.

1.7.3.2 WETLAND ACCESS

The only access roads other than the construction ROW which can be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland. Construction equipment operating in wetland areas should be limited to that needed for the installation or maintenance of transmission lines. All other construction equipment should use access roads

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located in upland areas to the maximum extent possible. In situations where upland access roads
do not provide sufficient access, construction equipment may pass through the wetland.

1.7.3.3 HAZARDOUS MATERIAL

Dairyland or its contractors should not store hazardous materials, chemicals, fuels, lubricating
oils, or perform concrete coating activities within 100 feet of streams or within municipal
watershed areas (except at locations within these areas that are designated for these purposes by
an appropriate governmental authority).

1.7.3.4 REFUELING

Refuel construction equipment at least 100 feet from streams. Where conditions require
construction equipment (e.g., barge-mounted backhoes, trench dewatering pumps) be refueled
within 100 feet of streams, the Contractor must take appropriate spill prevention precaution
procedures.

1.7.3.5 DEWATERING

Dewatering may be required during construction- or maintenance-related activities. Water
should be emptied in a sediment trap before discharging to the wetland so that silt-laden water
does not enter wetlands.

1.7.3.6 REVEGETATION

1. FERTILIZER AND LIME REQUIREMENTS

The establishment of vegetation may be required in wetland areas. Do not apply fertilizer or
lime, unless required in writing by the appropriate state permitting agency.

2. MULCHING

State approval is necessary for mulching in wetlands. Straw or hay can be used as mulch but must be free of noxious weed contaminants.

3. TEMPORARY VEGETATION

Temporarily vegetate disturbed areas with the appropriate seed specified in Section 1.5, unless
standing water is prevalent or permanent planting or seeding with native wetland vegetation is
established.

4. PERMANENT REVEGETATION

Consult with a wetland scientist for a vegetation plan.
1.7.3.7 Temporary Wetland Crossing

Temporary wetland crossing options include wood mats, wood panels, wood pallets, bridge decking, expanded metal grating, polyvinyl chloride (PVC) and high density polyethylene (HDPE) pipe mats or plastic road, tire mats, corduroy, pole rails, wood aggregate, and low ground pressure equipment. Temporary wetland crossings should be avoided unless absolutely necessary. Successful crossings are enhanced with a root or slash mat to provide additional support for equipment and geotextile to segregate the crossing from underlying soil and provide floatation. Temporary wetland crossing options will be discussed in further detail below.

1. Wood Mats

Wood mats are individual cants, sawdense hardwood (oak), or round logs cabled together to make a single-layer crossing.

Wood mats provide a surface that protects wetlands during hauling or equipment-moving operations. A 3-m (10-foot) long, 10 cm by 10 cm (4 inch by 4 inch) center log is the recommended minimum size. If the surface of the crossing becomes slippery, add expanded metal grating to provide traction.

2. Wood Panels

Nail two-layer wood panels parallel to the perpendicular wood planks where tires will cross. Interconnecting adjacent panels in a crossing will help minimize the rocking that occurs when vehicles drive over the panels. In addition, it will improve the overall flotation provided by the crossing. If panels are not interconnected, approximately 150 mm (6 inches) should be left between the individual panels to facilitate installation and removal.

3. Wood Pallets

Wood pallets are constructed with three layers of pallets similar to those used for shipping and storage but specifically designed to support traffic. Wood pallets are commercially available and are constructed to be interconnected and are reversible.

4. Bridge Decking

Decking of a timber bridge can be used to cross a small wetland area. Individual panels should be placed across the area with soft soil and approach ramps to the decking built.

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5. **Expanded Metal Grating**

Commercial available metal grating can support machine weight by distributing it over a broader area. Expanded metal and deck span are two commercially-tested types of grating for wetland crossings. The expanded metal is recommended due to the regular non-galvanized steel that comes in various thicknesses and different opening sizes.

6. **Corduroy**

Corduroy is a crossing made of brush, small logs cut from low-value and noncommercial trees on-site, or mill slabs that are laid perpendicular (most often) or parallel to the direction of travel. The greater the surface area of the corduroy the greater the floatation capability of the crossing. Placing geotextile provides additional support and segregation of brush, logs, or mill slabs from underlying soil.

7. **PVC and HDPE Pipe Mats or Plastic Road**

A portable, reusable, lightweight corduroy-type crossing can be created with PVC or HDPE pipe mats. Pipe mats work as a conduit and allow water to move through the crossing without further wetting the area.

8. **Pole Rails**

One or more straight hardwood poles cut from on-site trees can be laid parallel to the direction of travel below each wheel. The diameter of the poles should not exceed the 10-inch diameter on the large end so they are able to penetrate the wet area to a sufficient depth that the tires come in contact with the soil. This method will not work with machinery that is equipped with conventional width tires because they are too narrow and are operated at too high a pressure to stay on top of the poles.
9. **WOOD AGGREGATE**

Use wood particles, varying in size, to fill soft soil areas. This is a popular method because the wood is relatively light in weight, which gives it better natural flotation than gravel. Wood, being a naturally biodegradable material, will allow water to flow freely through, causing no change to the natural hydrologic flows.

10. **LOW GROUND PRESSURE EQUIPMENT**

Low pressure equipment exerts ground pressure of less than 5 or 6 psi. Low ground pressure equipment reduces this pressure by reducing overall machine weight, or by increasing the contact area between the equipment and soil, spreading the weight over a larger surface area. By reducing ground pressure at each contact point, equipment flotation is enhanced, traction is usually improved, and road maintenance requirements, such as grading, can be reduced. Low ground pressure equipment can also reduce rut depth and compaction, and can result in reduced fuel consumption.\(^{49}\)

1.7.4 **Stream and River Crossings**

Pre-construction planning is an essential part of accommodating safe movement of equipment across streams. Crossing requirements, including construction methods, timing, erosion control, and restoration, are described in this section and in the stream crossing permits issued by state agencies. If site conditions or engineering constraints make any of these requirements infeasible, Dairyland may propose alternative provisions at equal or greater level of protection to the environment than the original requirements. Modification of terms of any permit will also require regulatory agency approval prior to construction. The Contractor must receive Dairyland’s approval prior to implementing the alternatives.

Use the procedures in this section when crossing streams, rivers, and other permanent waterbodies, such as ponds and lakes. These procedures require that judgment be applied in the field and must be implemented under the supervision of the Contractor. Report non-compliance with these procedures to the Contractor for remedial action. Alternative procedures outlined in any project-specific plan or permit will supersede the requirements of this section.

1.7.4.1 TIME WINDOW FOR CONSTRUCTION

Stream crossings will be constructed during the following time windows unless directed differently in writing by the appropriate state agency on a site-specific basis.

- Cold water fisheries – June 1 through September 30
- Warm water fisheries – June 1 through November 30

1.7.4.2 HAZARDOUS MATERIALS

Dairyland or its contractors should not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities within 100 feet of streams or within municipal watershed areas (except at locations within these areas that are designated for these purposes by an appropriate governmental authority).

1.7.4.3 REFUELING

Refuel construction equipment at least 100 feet from streams. Where conditions require construction equipment (e.g., barge-mounted backhoes, trench dewatering pumps) be refueled within 100 feet of streams, the Contractor must take appropriate spill prevention precaution procedures.

1.7.4.4 ALIGNMENT OF CROSSING

Construct stream crossings as close to perpendicular to the axis of the stream channel as engineering and routing constraints allow.

1.7.4.5 TEMPORARY EQUIPMENT CROSSINGS

Temporary stream crossing is required to provide safe, erosion-free access across a stream for construction equipment. Temporary stream crossings are fords, culverts, PVC and HDPE pipe bundles, and portable or on-site constructed bridges. Unless it is absolutely necessary, stream crossing should be avoided. Use existing stream crossing locations if crossing is unavoidable and the existing crossing can withstand the weight. Properly designed, installed, and maintained temporary stream crossings can greatly reduce costs and help meet concerns of regulating agencies.
If a stream crossing is needed it should be limited to as few as possible and should be as short as possible. To correctly cross a stream, the crossing should be located on a straight segment of the stream channel that has low banks (except for bridge crossings where higher banks are preferred to support the abutments). Contact a local engineer or hydrologist to determine permitting needs for the stream crossings, if needed. Temporary stream crossing options will be discussed in further detail below.

1. **Fords**

A ford utilizing the streambed is used when flows are consistently less than 600 mm (2 feet) deep, as part of the road or access trail, and is best for short-term, limited traffic. Fords should not be constructed or used during periods of fish spawning and migration. If the crossing location has a mucky or weak streambed a base must be constructed. A permanent constructed ford consists of gravel or rock or a temporary ford consists of mats made of wood, expanded metal, logs or poles, or a floating rubber mat.

**Permanently Constructed Fords**

To properly construct a permanent ford, the muck or weak streambed material should be excavated prior to the minimum of 6–inch installation of fill. Installing a geotextile prior to gravel or rock fill is recommended to provide extra support and separate material from weak native soil.

**Temporarily Constructed Fords**

Mats made of wood using expanded metal grading, logs, or floating rubber mats provide a firm base for a temporary ford. If the streambed or bank is too weak for geotextile and mats or expanded metal, supplemental corduroy, gravel, or rock fill may be needed to support the weakest portions of the crossing. For crossings only used a few times, a log or pole ford may be best. The stream channel is filled with logs laid parallel to the flow of the stream.

2. **Culverts**

A culvert is a structure that conveys water under a road or access trail. Culverts are the most common methods of crossing intermittent and perennial streams. There are manufactured culverts that come in various shapes, lengths, and diameters. Manufactured culverts are made of corrugated steel, concrete, or polyethylene. Proper sizing with a minimum of a 375-mm (15-inch) diameter and installation of culverts is crucial for a successful crossing. Other materials, such as steel piling, wooden box culverts, and hollow logs can be used as culverts as well.

Photo 1.0: Culvert
3. PVC AND HDPE PIPE BUNDLES

A pipe bundle crossing is constructed using a 4-inch diameter schedule 40 PVC or Standard Dimension Ratio (SDR) 11 HDPE pipes that are cabled together forming loose mates that can be formed into bundles. The bundles allow water to pass through and provide mechanical support for vehicle traffic. The pipe bundle crossing is constructed by initially placing a geotextile fabric then a layer of connected pipes is placed parallel to stream flow.

4. BRIDGES

Bridges keep fill and equipment out of the water better than any other stream crossing option. Temporary bridges can be constructed from ice, timber, steel, or pre-stressed concrete. A licensed engineer must review the design of any bridge that is fabricated from locally available materials, otherwise, manufactured bridges are made for various span lengths and load capacities.

Ice Bridges

Ice bridges are most common stream crossing methods during winter months with night temperatures below 0 degrees Fahrenheit (°F) with several days to build up thick enough ice. An estimated formula was developed to estimate minimum ice thickness to support a given load.

Where:

- ice thickness in inches
- the load or gross weight of the vehicle plus its contents, in tons
Timber Bridges
Two common designs for timber bridges are the log stinger bridges and solid sawn stringer bridges with or without a plank deck. Log stringer bridges are built by cabling logs together from trees felled in the area of construction. Solid sawn stringer bridges are built with new lumber, railroad ties, or demolition materials.

Steel Bridges
Steel-hinged bridge and modular bridges are two types of steel bridges. Steel-hinged bridges fold up for transport, and modular steel bridges are designed with individual panels that interlock forming a bridge of variable length.

Pre-stressed Concrete Bridges
Fabricated pre-cast, pre-stressed concrete panels are placed side-by-side to form a bridge. The bridge panels must be designed to accommodate the load capacity needed for the crossing.

1.7.5 Trout Stream
Trout require cool, clear streams. Trout and aquatic insects they feed on are especially sensitive to increased sedimentation. It is therefore important to take special precautions to minimize sedimentation and maintain a shade cover to prevent excessive warming of the water. Previously mentioned practices and temporary crossings are applicable in addition to the following:

- Drain water from roads and skid roads onto ridges and side slopes. Drainage structures should not divert water directly into streams.
- Re-vegetate exposed soils following road construction as soon as possible to take advantage of the loose soil conditions for seeding.
- Use mulch, gravel, and/or rock to help stabilize fills where roads and skid roads cross streams.
1.8 POLLUTION PREVENTION MANAGEMENT MEASURES

1.8.1 Spill Cleanup

Spill prevention and planning is the framework under which an outline of how a facility will prevent hazardous spills, as well as how it plans to control and contain spills from reaching surface water. This section provides Dairyland’s policy and procedures for spill prevention, control, cleanup, and training.

**FYI**

Spills can be cleaned up by using absorbent material, which can then be scooped up and properly disposed.

1.8.1.1 SPILL PREVENTION

1. Develop procedures to prevent/mitigate spills to storm drain systems.
   - Standardize reporting procedures, containment, storage and disposal activities, documentation, and follow-up procedures.

2. Post “No Dumping” signs in appropriate substation locations with a phone number for reporting illegal dumping and disposal.

3. Conduct routine cleaning, inspections, and maintenance.
   - Sweep and clean storage areas. Do not hose down areas to storm drains or other inlets.
   - Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during filling and unloading of tanks. Reuse, recycle, or properly dispose of any collected liquids or soiled absorbent materials.
   - Check tanks (and any containment sumps) frequently for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.
   - Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.
   - Inspect tank foundations, connections, coatings, tank walls, and piping system.

4. Properly store and handle chemical materials.
   - Designate a secure material storage area that is paved with concrete, free of cracks and gaps, and impervious to contain leaks and spills.
   - Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
• Keep chemicals in their original containers, if feasible.
• Keep containers well labeled according to their contents (e.g., solvent, gasoline).
• Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, and poisonous).
• Prominently display required labels on transported hazardous and toxic materials (per U.S. DOT regulations).

5. Utilize secondary containment systems for liquid materials.
• Surround storage tanks with a berm or other secondary containment system.
• If berm is used for secondary containment, slope the area inside the berm to a drain.
• Drain liquids to the sanitary sewer, if available. Do not discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required.
• Pass accumulated stormwater in petroleum storage areas through an oil/water separator.
• Use catch basin filtration inserts.

6. Protect materials stored outside from stormwater. Construct a berm around the perimeter of the material storage area to prevent run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.

Did You Know?

Most people think of pollutants as chemicals like ammonia, oil, and pesticides, however, soap, cleaners, caffeine, and food can also negatively impact the environment when carried into surface waters.

7. Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.

1.8.1.2 SPILL CONTROL AND CLEANUP ACTIVITIES
1. Identify key spill response personnel.
2. Clean up leaks and spills immediately.
• Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
• Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then used cleanup materials are also hazardous and must be sent to a certified laundry or disposed of as hazardous waste.
Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or hazardous material team may be necessary.

1.8.1.3 REPORTING

1. Report spills that pose an immediate threat to human health or the environment to local agencies.
   - Illinois – Illinois Emergency Management Agency (217) 782-7860 or (800) 728-7860
   - Iowa – Iowa DNR (515) 281-8694
   - Minnesota – Minnesota Pollution Control Agency (State Duty Office) (651) 649-5451 or (800) 422-0798
   - Wisconsin – Wisconsin DNR (800) 943-0003

2. Establish a system for tracking incidents. The system should be designed to identify the following:
   - Types and quantities (in some cases) of wastes
   - Patterns in time of occurrence (time of day/night, month, or year)
   - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
   - Responsible parties

3. Federal regulations require that any oil spilled into a water body or onto an adjoining shoreline must be reported to the National Response Center (NRC) at (800) 424-8802 (24-hour).
1.8.1.4 TRAINING

1. Educate employees about spill prevention, cleanup, and reporting.
   - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up spills.
   - Educate employees on aboveground storage tank requirements.
   - Train all employees upon hiring and conduct annual refresher training.

2. Train employees responsible for aboveground storage tanks and liquid transfers on the SPCC plan.

1.8.2 Trash and Debris

Contractors shall keep the work site clean. Trash and debris shall not be buried within fill or backfill. Collect construction, demolition, clearing, grubbing debris, and other trash weekly for disposal off-site. No on-site burning is permitted. Contractors shall comply with federal, state, and local requirements for the disposal of solid waste.

1.8.3 Hazardous Material

Oils, fuels, and hazardous substances must be properly stored, including secondary containment for tanks larger than 50 gallons, to prevent spills. Restricted access to storage areas must be provided to prevent vandalism. Storage and disposal of hazardous materials must be in compliance with federal, state, and local regulations.
1.9 GENERAL PROVISIONS

1.9.1 Maintenance

1. DURING CONSTRUCTION

It is the Contractor’s responsibility to maintain silt fence and other temporary erosion and sediment controls in working order throughout the project. Maintenance shall include the following:

- Sediment trap shall be at 50 percent capacity.
- Excess sediment behind silt fences and biorolls shall be removed and properly disposed when sediments reach one-third the height of the structure.
- Tracked sediments will be removed from paved surfaces at the end of each day.
- Construction entrances/exits shall be maintained daily.

Remove all remaining temporary BMPs and accumulated silt fences 30 days after site has undergone final stabilization.

2. AFTER CONSTRUCTION

Table 12
After Construction BMP Maintenance Activity and Schedule

<table>
<thead>
<tr>
<th>BMP</th>
<th>Activity</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention Pond/Wetland¹</td>
<td>• Cleaning and removal of debris after major storm events</td>
<td>Annual or as needed</td>
</tr>
<tr>
<td></td>
<td>• Harvest excess vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Repair of embankment and side slopes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Removal of accumulated sediment from forebays or sediment storage areas</td>
<td>5-year cycle, or as needed</td>
</tr>
<tr>
<td></td>
<td>• Removal of accumulated sediment from main cells of pond once the original volume has been significantly reduced</td>
<td>5- to 10-year cycle</td>
</tr>
<tr>
<td>Detention Basin</td>
<td>• Removal of accumulated sediment</td>
<td>Annual or as needed</td>
</tr>
<tr>
<td></td>
<td>• Repair of control structure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Repair of embankment and side slopes</td>
<td></td>
</tr>
<tr>
<td>Infiltration Trench²</td>
<td>• Cleaning and removal of debris after major storm events</td>
<td>Annual or as needed</td>
</tr>
<tr>
<td></td>
<td>• Mowing⁴ and maintenance of upland vegetated areas</td>
<td></td>
</tr>
<tr>
<td>Infiltration Basin²</td>
<td>• Cleaning and removal of debris after major storm events</td>
<td>Annual or as needed</td>
</tr>
<tr>
<td></td>
<td>• Mowing⁴ and maintenance of upland vegetated areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Removal of accumulated sediment from forebays or sediment storage areas</td>
<td>3- to 5-year cycle</td>
</tr>
<tr>
<td>BMP</td>
<td>Activity</td>
<td>Schedule</td>
</tr>
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<td>---------------------</td>
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</tr>
</tbody>
</table>
| Sand Filters\(^3\) | • Removal of trash and debris from control openings  
• Repair of leaks from the sedimentation chamber or deterioration of structural components  
• Removal of the top few inches of sand and cultivation of the surface when filter bed is clogged (only works for a few cycles)  
• Clean-out of accumulated sediment from filter bed chamber  
• Clean out of accumulated sediment from sedimentation chamber | Annual or as needed     |
| Bioretention\(^5\)  | • Repair of eroded areas  
• Mulching of void areas  
• Removal and replacement of all dead and diseased vegetation  
• Watering of plant material  
• Removal of mulch and application of a new layer | Bi-annual or as needed  |
| Grass Swale\(^3\)   | • Mowing\(^4\) and litter and debris removal  
• Stabilization of eroded side slopes and bottom  
• Nutrient and pesticide use management  
• De-thatching swale bottom and removal of thatching  
• Disking or aeration of swale bottom  
• Scraping swale bottom and removal of sediment to restore original cross section and infiltration rate  
• Seeding or sodding to restore ground cover (use proper erosion and sediment control) | Annual or as needed     |
| Filter Strip\(^3\)  | • Mowing\(^4\) and litter and debris removal  
• Nutrient and pesticide use management  
• Aeration of soil in the filter strip  
• Repair of eroded or sparse grass areas | Annual or as needed     |

\(^1\) Modified from Livingston et al (1997)  
\(^2\) Modified from Livingston et al (1997), based on grass swale recommendations  
\(^3\) Modified from Claytor and Schueler (1996)  
\(^4\) Mowing may be required several times a year, depending on local conditions  
\(^5\) Modified from Prince George’s County (1993)
1.9.2 Inspections

1. During Construction

Inspections are required for all temporary erosion and sediment controls at least once every 7 days, within 24 hours of rainfall events that produce more than 0.5 inches of rain in a 24-hour period or greater, or a snowmelt event that cause surface erosion. Conduct inspections at least once per month where runoff is unlikely (due to winter conditions). Keep records for each inspection and maintenance activity and contain the following information:

- Date and time of inspection
- Name of person(s) conducting inspection
- Findings of inspections, including recommendations for corrective action
- Corrective actions taken, including dates, time, and party completing maintenance activities
- Date and amount of all rainfall events that produce more than 0.5 inches of rain in a 24-hour period or greater

2. After Construction

Inspect permanent BMPs annually for the first 3 years and every 3 to 5 years thereafter.

1.9.3 Record Keeping and Reporting

Recordkeeping is a simple, easily implemented, and cost-effective management tool. Recordkeeping manages the life cycle of the record by assessing the records values and setting the standards by which records are retained and disposed of. There are three distinct phases in a record’s life cycle:

- Phase 1 – the time at which a record is created or received and is of immediate value
- Phase 2 – the point at which records have ongoing value and use but are no longer referred to on a regular basis
- Phase 3 – the point at which records have no further operational use and are disposed of either by destroying them or transferring them to the archive location where they are preserved

Complete, well-organized records help ensure proper maintenance of facilities and equipment and can assist in determining the causes of erosion, sedimentation, spills, and leaks, thus recordkeeping can protect water quality by helping to prevent future problems.

Records shall be maintained for at least 5 years from the date of sample observation, measurement, or spill report. The key to maintaining records is continual updating. New information, must be added to existing inspection records or spill reports as it becomes available. In addition, update records if there are changes to the number and location of discharge points, principal products, or raw material storage procedures.

Some simple techniques used to accurately document and report results include:

- Field notebooks
- Timed and dated photographs
- Videotapes
- Drawings and maps
- Computer spreadsheets and database programs

As appropriate, Dairyland should maintain records demonstrating successful implementation of BMPs. Recordkeeping may include training, site inspection and maintenance, and, if relevant, monitoring.

1.9.3.1 TRAINING AND WORKSHOPS

Records of all training sessions provided to staff should be maintained to allow for:

- Determining which staff requires which training
- Determining when training sessions must be conducted
- Documenting training activities for enforcement and compliance purposes

1.9.3.2 SITE INSPECTION AND BMP MAINTENANCE

Inspection reports should be kept to track frequency and results of inspections, condition of BMPs inspected, and follow-up actions taken. It is also important to keep a record of maintenance activities or any other BMPs that are of an “action” nature. It is easy to demonstrate that a BMP that involves a physical change, such as berming or covering, has been accomplished. However, actions that relate to good environmental judgment can only be demonstrated by recordkeeping. Besides demonstrating compliance, records can assist in BMP management. Keeping a record of detention pond cleaning, for example, also provides insight into how long it takes for the pond to refill.
1.9.3.3 TRAINING

Education and training is the key to the success of BMP implementation. Dairyland shall adopt a training program which will address the following subjects:

- Maintenance Procedure Implementation and Inspection – In this training effort, proper procedures for performing activities that may adversely affect stormwater quality are addressed. Maintenance procedures cover a wide range of activities and the training may address either all maintenance procedures applicable to Dairyland or a specific procedure (e.g. detention pond cleaning, fertilizer, and pesticide use). This training can be conducted in either a formal or a tailgate-style format.

- Pollution Prevention/Spill Awareness – This training addresses the general techniques Dairyland’s staff may implement to prevent pollution, as well as to respond to spills once they have occurred. Training can be tailored to management and staff who oversee pollution prevention measures, to field staff conducting activities that may result in spills, or to field staff who may encounter spills or illicit discharges.