

Minnesota Public Drainage Manual

Chapter 5 – I,II. Public Drainage System Best Management Practices (BMPs)

Summary

Chapter 5 presents a compilation of Best Management Practices (BMPs) that are specifically applicable to public drainage systems in Minnesota. The chapter and its contents support the work of ditch authorities, their staff and engineers by providing guidance and tools to address design, maintenance, repair, and water quality and quantity issues on and in the watershed of [Minn. Stat. 103E](#) drainage systems.

Chapter 5 provides a resource for users with varied levels of experience using BMPs on Minn. Stat. Chapter 103E systems. Reference to relevant statutes, a **BMP Table**, and BMP definitions are provided.

The BMPs provided support Minn. Stat. Chapter 103E Drainage Law in two (2) primary ways:

1. BMPs that provide information and support for drainage authorities work through the drainage system design and construction considerations required by:

- i. [Minn. Stat. 103E.015](#), Considerations Before Drainage Work is Done, subd. 1, 1(a), and 2

2. BMPs that supplement and enhance drainage system repair, maintenance, and management activities addressed by:

- i. [Minn. Stat. 103E.021](#), Ditches Must Be Planted With Perennial Vegetation, subds. 1, 2, and 6;
- ii. [Minn. Stat. 103E.227](#), Impounding, Rerouting, and Diverting Drainage System Waters, subd. 1(a);
- iii. [Minn. Stat. 103E.701](#), Repairs, subd. 1 and 6;
- iv. [Minn. Stat. 103E.705](#), Repair Procedure, subds. 1 and 3; and
- v. [Minn. Stat. 103E.715](#), Procedure for Repair by Petition, subd. 6.

For the purposes of this manual, a BMP is a structural or non-structural practice that minimizes water quality and/or quantity (peak flow or volume reduction) impacts within a public drainage system or its watershed.

There are two (2) types of BMPs:

1. On-System

On-system BMPs are used within a Chapter 103E drainage system and include any statute-allowed, or required practice (i.e., vegetated buffer strips, grade control structures, side inlets, erosion control, multi-stage ditch, water storage, restored wetland, culvert sizing, resloping, tile repair, etc.). Many of such practices do not have a design standard.

2. Off-System

BMPs implemented off the Chapter 103E drainage system are not within the traditional purview of the drainage authority. Practices applied on fields and farms in the watershed of system can provide significant benefits downslope to the drainage system. Drainage inspectors and drainage system engineers should be aware of the potential for off-system BMPs to solve on-system problems.

- **Typical structural off-system BMPs:** Water and sediment control basins, grass waterways, Drainage Water Management (DWM); and
- **Typical non-structural off-system BMPs:** nutrient management, cover crops, conservation tillage, etc.

Other resources from which the BMPs provided within this chapter are also cited include (**Section I, E**):

- Minnesota Stormwater Manual;
- USDA's Field Office Technical Guide (FOTG)/The Ag BMP Handbook for Minnesota;
- NRCS Engineering Field Handbook; and
- Red River Basin TSAC, Technical Paper No. 15.

The suggested method for navigating through the BMP identification process and how to use Chapter 5 includes three (3) steps (**Section I, F**):

- **Step 1:** Observe and identify potential problems and opportunities;
- **Step 2:** Determine the cause of the problem; and
- **Step 3:** Select an appropriate BMP solution to address the problem/symptom or cause (Use of the **BMP Table**).

The **Best Management Practices (BMPs) Table** sorted by issue/cause and on-system and off-system BMP solutions, along with BMP definitions are provided within **Section II**.

A. Chapter Purpose

The purpose of this chapter is to provide a compilation of BMP information specifically tailored to public drainage systems in Minnesota. The chapter supports the work of ditch authorities, their staff and engineers by providing guidance and tools to address design, maintenance, repair, and water quality and quantity issues on and in the watershed of [Minn. Stat. 103E](#) drainage systems.

B. Chapter History and Background

Soon after it was established in 2005, the [Stakeholder Drainage Work Group \(DWG\)](#) recommended the inclusion of a Best Management Practices Chapter in the updated Minnesota Public Drainage Manual (MPDM). The addition of what is now the new Chapter 5 – Public Drainage System Best Management Practices has been a part of a number of MPDM Update funding requests dating back to early 2007. The 2013 appropriation language providing funding for the update of the MPDM specifically required the inclusion of the BMP chapter.

The BMP chapter was first envisioned by the DWG as a guide to inspectors and engineers for drainage system maintenance and repair work. However, the scope of the chapter has been expanded to support potential BMP implementation related to recent changes to [Minn. Stat. 103E.015](#), Considerations

Before Drainage Work is Done, Subdivision 1. Environmental, land use, and multipurpose water management criteria. (Refer to **Chapter 3, I, B** for a full discussion of [Minn. Stat. § 103E.015](#).)

C. Relation to Drainage Law and Drainage System Management

While there are few requirements in Drainage Law that necessitate drainage authorities' use of specific BMPs in their administration of [Minn. Stat. 103E](#) drainage systems, BMPs can improve the function and stability of the system for drainage purposes, as well as support the environmentally effective application of drainage law. The BMPs provided in this chapter support Chapter 103E Drainage Law in two primary ways.

First, the BMPs presented in this chapter provide information and support for drainage authorities work through the drainage system design and construction considerations required by the following Statute:

- [Minn. Stat. § 103E.015](#), **Considerations before drainage work is done, Subdivisions 1, 1a, 2.**

These changes resulted in the requirement of “consideration” of multipurpose water management criteria. The full list of environmental, land use, and multipurpose water management criteria as listed in [Minn. Stat. § 103E.015 Subd. 1](#) are presented in **Chapter 3** of the Minnesota Public Drainage Manual. Consideration of these criteria ensures that BMPs are evaluated during the planning and design of a drainage project (as defined in [Minn. Stat. § 103E.005, Subd 11](#)).

Second, the BMPs presented in this chapter supplement and enhance drainage system repair, maintenance, and management activities addressed by the following Statutes:

- [Minn. Stat. § 103E.021](#) **Ditches must be planted with perennial vegetation. Subdivisions 1, 2 and 6.** Drainage authorities were first given permissive authority to require the minimum 1-rod grass strips in 1959. The vegetative buffer strips with a minimum of 1-rod (16.5-foot) width has been required on legal ditch systems since 1977 when a new legal ditch was established, the improvement of an existing ditch was completed, or during a redetermination of benefits. In 2007, ditch authorities were given the ability to incrementally install buffer strips on ditch systems without a separate viewing process. The 2007 revision to [Minn. Stat. § 103E.021](#) also allows for the incremental installation of side inlet pipes along ditch systems.

Note: During the 2015 Special Legislative Session, Governor Dayton signed into law [Minn. Stat. § 103F.48](#) that requires buffers or alternative practices to be established on all public drainage ditches by landowners no later than November 2018. As of 2021, buffers or alternative practices are in place on approximately 99 percent of all parcels subject to the statute statewide. It is important to note that buffers established solely under § 103F.48 do not formally become a part of the 103E system unless dictated by other formal 103E processes. Specifically, public ditch buffers placed under the statute only become 103E buffers if and when the drainage authority acquires them as a part of the drainage system. Until then the landowner is required to maintain the buffers.

- [Minn. Stat. § 103E.227](#) **Impounding, rerouting, and diverting drainage system waters, Subd. 1.a.** allows for impounding, rerouting, and diverting of drainage system waters. Subd 1.a provides one pathway along which external organizations can interact with the drainage authority in regard to management of drainage waters. “To conserve and make more adequate use of our water resources or to incorporate wetland or water quality enhancing elements as authorized by [Minn. Stat. § 103E.011, subdivision 5](#), a person, public or municipal corporation,

governmental subdivision, the state or a department or agency of the state, the commissioner of natural resources, and the United States or any of its agencies, may petition to impound, reroute, or divert drainage system waters for beneficial use.” Typically this section has been used to restore wetlands on a drainage system, or divert flows into multipurpose flood control impoundments.

- **[Minn. Stat. § 103E.701](#) Repairs. Subd, 1, and 6.** This section also supports the use of BMPs on drainage systems. Subdivision 1 includes provisions for “resloping of ditches and leveling of spoil banks if necessary to prevent further deterioration, realignment to original construction if necessary to restore the effectiveness of the drainage system”. It also allows for incidental straightening of tile systems and replacement of tile with the next larger size that is readily available. Subdivision 6 provides for repair of a drainage system including the preservation, restoration, or enhancement of wetlands; wetland replacement; the realignment of a drainage system to prevent drainage of a wetland; and the incorporation of measures to reduce channel erosion and otherwise protect or improve water quality.
- **[Minn. Stat. § 103E.705](#) Repair procedure. Subdivisions 1 and 3.** This section lays out procedures for dealing with inspection, buffer strip violations and repair after a disaster.
- **[Minn. Stat. § 103E.715](#) Procedure for repair by petition. Subdivision 6.** This section provides a procedure for repair by resloping ditches, incorporating multistage ditch cross-section, leveling spoil banks, installing erosion control, or removing trees.

D. Best Management Practices

1. Definition

In this manual, a Best Management Practice (BMP) is a structural or non-structural practice that minimizes water quality and/or quantity (peak flow or volume reduction) impacts within a public drainage system or its watershed and/or downstream.

BMPs are of two types: on-system and off-system.

a. On-System

On-system BMPs are used within a [Minn. Stat. Chapter 103E](#) drainage system and are aligned with the statute-based authorities and responsibilities of the drainage authority. These can include any statute-allowed, or required practice, i.e., vegetated buffer strips, grade control structures, side inlets, erosion control, multi-stage ditch, water storage, restored wetland, culvert sizing, resloping, tile repair, etc. Many of the on-system practices do not have a design standard.

b. Off-System

Other BMPs are located off the [Minn. Stat. 103E](#) drainage system, and consequently, not within the traditional purview of the drainage authority. However, as a result of efforts related to [Minn. Stat. § 103E.015](#), a drainage authority may find that there are practices that can be applied on fields and farms in the watershed of the system which will provide significant benefits downslope to the drainage system. Typical structural off-system BMPs might include water and sediment control basins, grass waterways, and Drainage Water Management (DWM) to name a few. Typical non-structural off-system BMPs would be nutrient management, cover crops, and conservation tillage, etc. that are applied on

lands within the watershed of the system. It is important for both the drainage inspector and the drainage system engineer to become aware of the potential for off-system BMPs to solve on-system problems.

E. Other Resources

The BMPs covered in the **BMP Table** include many BMPs associated with public drainage systems in Minnesota.

1. Minnesota Stormwater Manual

Temporary construction stormwater BMPs used during construction activities are not covered explicitly. BMPs for temporary construction-related erosion and sediment control and stormwater management can be found on the [Minnesota Stormwater Manual website](#), managed by the MN Pollution Control Agency.

2. USDA's Field Office Technical Guide (FOTG)/The Ag BMP Handbook for Minnesota

Further information about a few on-system BMPs and many well-documented standards for off-system BMPs can be found in the [USDA's FOTG](#) and Minnesota Department of Agriculture's [Ag BMP Handbook for Minnesota](#) (published in 2012 and updated in 2017).

3. NRCS Engineering Field Handbook

The [NRCS Engineering Field Handbook – Part 650](#) of the NRCS National Engineering Handbook – provides information and design guidance on how to utilize the BMP specifications contained in the FOTG.

4. Red River Basin TSAC, Technical Paper No. 15

Culvert sizing is presented in [Technical Paper 15](#).

F. How to Use this Chapter

Step 1: Observe and identify potential problems and opportunities

On existing public drainage systems, look for symptoms or potential indications of a problem through the use of field observations, inspector or engineer's reports, studies, local water plans (see note below) or strategies defining what is happening in the watershed of the public drainage system. On new public drainage system establishments, professional judgment is required to site BMP to minimize any adverse impacts. Lessons learned from experience with other drainage systems should be considered in the design of the new system.

Problems/symptoms are the physical issues identified along a public drainage system.

Examples might include:

- Headcut on adjacent fields
- Reduced water quality in nearby or downstream receiving waters
- Sediment plumes
- Channel erosion
- Ditch incision

- Fish kills
- Sediment plugged tile
- Erosion on near-ditch field
- High concentrations of pollutants in system waters
- Failed side slope
- Etc.

While investigating **Sources of External Funding per [Minn. Stat. § 103E.015, Subd. 1a.](#)**, a drainage authority may find that funding is available through a local water planning organization, state or federal agency, or other entity to accomplish multipurpose water management practices to benefit a drainage system while benefiting downstream water resources and landowners. An example of such an opportunity might be finding a landowner that desires to place a grassed waterway in the watershed of a drainage system that is experiencing extensive sedimentation from field erosion.

Note: Local water management plans are created and maintained by local government units that have responsibility to protect and improve local water resources. The intent of each local water plan is to guide management of water resources for multiple purposes. When the plan is implemented through any LGU, drainage authority (in the present case) or landowner, another step is taken in multipurpose water management within the jurisdiction of the planning organization. Such a focus benefits not only local water resources, but also downstream waters in Minnesota and in due course water bodies downstream of Minnesota, such as the Gulf of Mexico and Lake Winnipeg.

Step 2: Determine the Cause of the Problem

In order to select an appropriate BMP or BMPs, the causes of the problem must be considered. Causes are the underlying root or roots to the symptoms/problems identified along the system, or immediately upstream or downstream of the legal public drainage system.

Examples might include:

- Open tile inlets
- Lack of buffers
- Excessive use of nitrogen fertilizers or manure
- Lack of cover crops
- Excessive phosphorus loss through tile systems creating impaired downstream waterbodies
- Altered hydrology
- Excessive phosphorus build-up in the soil
- Downstream channel straightening
- Ground subsidence may cause old tile to separate, shift, and plug
- Excessive bank slope

- Excessive bottom slope
- Etc.

Note: Watershed Restoration and Protection Strategies, Stressor Identification Reports, and One Watershed One Plan reports can be useful in this step in helping to identify the contributing factor(s) or cause(s) of the problem(s).

Step 3: Select an Appropriate Solution

Use of the Matrix

A solution in the **BMP Table** is a BMP or suite of BMPs that together address a problem/symptom or address the cause. In general, an attempt to address the cause is preferred.

Note: The designer will want to consider whether to treat the symptom or the cause of the problem. In some cases, it may be necessary to only address the symptom when a larger more complex (and potentially more costly) project may be needed to address the determined cause(s). Professional judgment must be used in the selection of an appropriate BMP given site specific conditions.

BMPs are organized into the **BMP Table** by problems/symptoms and causes. A listing of potential BMP solutions is provided for each problem/cause. The user will enter the **BMP Table** using the problem/symptoms/causes determined in Steps 1 and 2 to identify a potential BMP(s).