TECHNICAL GUIDANCE MANUAL FOR THE IMPLEMENTATION OF THE WATERSHED MANAGEMENT ORDINANCE

BASED ON THE WMO AS AMENDED

FEBRUARY 15, 2018

ACKNOWLEDGMENTS

The development of this Technical Guidance Manual (TGM) would not have been possible without the efforts of MWRD staff and those authorized by the MWRD to perform work on its behalf. Special thanks to the WMO Advisory Committee, Advisory Technical Panel, and other stakeholders for their valuable guidance and suggestions throughout the development of this document.

Contact Information:

Director of Engineering

Metropolitan Water Reclamation District of Greater Chicago

100 E. Erie Street

Chicago, IL 60611

(312) 751-5600

TABLE OF CONTENTS

INTRODUCTION

ARTICLE 2: APPLICABILITY AND GENERAL PROVISIONS

ARTICLE 3: WATERSHED MANAGEMENT PERMIT REQUIREMENTS AND SUBMITTALS

ARTICLE 4: EROSION AND SEDIMENT CONTROL

ARTICLE 5: REQUIREMENTS FOR STORMWATER MANAGEMENT

ARTICLE 6: FLOOD PROTECTION AREAS

ARTICLE 7: REQUIREMENTS FOR SEWER CONSTRUCTION

ARTICLE 8: INFILTRATION / INFLOW CONTROL PROGRAM

ARTICLE 9: MAINTENANCE

ARTICLE 10: INSPECTIONS

ARTICLE 14: ADMINISTRATION

APPENDICES

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS REVISION TABLE

No.	Revision Description	Date
0	Original TGM	5/1/2014
1	Article 8, Appendix D, examples, and general edits	8/1/2015
2.0	Revision table, WMO amendment date, re-number based on re-written Article 2	3/20/2018
2.1	TOC updated for re-written Article 3	10/16/2018

INTRODUCTION

Purpose of the Technical Guidance Manual

The Watershed Management Ordinance (WMO) was adopted by the Metropolitan Water Reclamation District of Greater Chicago (**District**) and sets forth minimum requirements for the management of **stormwater**, **floodplains**, **wetlands**, and sewer construction for **developments** in **Cook County**. The WMO provides the specific regulations for **development** within **Cook County** while the **Technical Guidance Manual (TGM)** presents guidance on how to apply and meet the regulations for both project design and project implementation. The **TGM** includes the applicable references to the WMO and should be used as a companion document to the WMO for the preparation of **Watershed Management Permit** applications. The **TGM** provides the following types of information:

- Identifies when a **Watershed Management Permit** is needed;
- Identifies information required in support of a **Watershed Management Permit**;
- Provides clarification of WMO requirements and their applicability;
- Provides guidance on how to best achieve the WMO's requirements; and
- Provides examples to aid in meeting the requirements of the WMO.

The goal of the **TGM** is to allow applicants to correctly apply the WMO to their **developments**. The **TGM** is a useful resource intended to promote efficient and consistent permit submittals and review procedures. The technical approaches presented in the **TGM** are not mandatory in all cases; the intent is to provide guidance and examples on how to meet the standards of the WMO. Alternative methodologies that are not presented in the **TGM** may still be accepted by the **District**.

The guidance contained in the **TGM** will be a valuable resource for the following:

- Community officials and leaders;
- Design engineers and municipal/county engineers;
- Developers, property owners, land planners, and architects;
- **Enforcement officers**, consulting engineers, and **wetland specialists**; and
- Other interested parties.

The WMO provides standards for **development** that meet, or in some instances exceed, the requirements of local, state, and federal agencies. Whenever there is conflicting requirements between another ordinance and the WMO, the more restrictive regulation should be followed.

In addition, the WMO does not repeal any county or municipal ordinance or resolution passed to establish eligibility for the **National Flood Insurance Program (NFIP)**. The WMO is not intended to supplement, replace, or remove any responsibility that either **Cook County** or a **municipality** may have to maintain eligibility and good standing in the **NFIP**. Proper administration and enforcement of the **NFIP** within participating counties and **municipalities** is a requirement of the **NFIP**. For unincorporated areas, enforcement of the NFIP is the responsibility of **Cook County**. The **floodplain** requirements that are presented in Article 6 of the WMO either meet or exceed the **NFIP** requirements. While the WMO meets, and in some instances exceeds, the minimum technical requirements of the **NFIP** for **development** in the **floodplain**, not all administrative requirements are specifically addressed.

To ensure successful enforcement of the regulations contained in the WMO, a joint effort is required from both the **District** and local **municipalities**. The **District** relies on the local **municipality** as a liaison to inform, report, and educate its constituents on the WMO. It is critical that cooperation between the **District** and the **municipality** occurs so that **Watershed Management Permits** are only issued for those **developments** that meet the standards contained in the WMO. Additionally, it is crucial that the local **municipality** coordinates each project with the developer at the field level. Without proper field coordination and follow-through during construction, the WMO regulations will have little impact.

TGM Article Overview

The **TGM** is structured to provide users with a comprehensive overview of the requirements for obtaining a **Watershed Management Permit** for a **development**. The information provided in the **TGM** ranges from basic information on when a **Watershed Management Permit** is required to detailed information on performance standards and submittal requirements. The **TGM** is organized into articles which correspond to each article of the WMO. An overview of each **TGM** article is included in the following:

<u>Article 2: Applicability and General Provisions</u>

Article 2 presents an overview of the scope of regulation and applicability of the WMO to **development** within **Cook County**. The goal of this article is to provide users with an understanding of when a **development** requires a **Watershed Management Permit**. Clarification on permitting is also provided for **special cases of development**, which includes **multi-county municipalities**.

<u>Article 3: Watershed Management Permit Requirements and Submittals</u>

The intent of Article 3 is to provide users with an understanding of the applicability of the WMO to all types of **development**. Flowcharts have been developed to assist applicants in navigating the permit process in order to determine when a **Watershed Management Permit** is required, and to determine which submittals are necessary. The necessary paperwork, including the **Watershed Management Permit** application and associated schedules, are detailed in this section. This article also provides guidance on the submittal requirements for each project, and includes checklists that detail the required items for each submittal.

Article 4: Erosion and Sediment Control

Article 4 presents guidance on the **erosion** and **sediment** control requirements contained in the WMO, and more specifically how they relate to the requirements of the General **National Pollutant Discharge Elimination System (NPDES)** Permit for Stormwater Discharges from Construction Site Activities (General NPDES Permit ILR-10). The article also provides an inventory of acceptable **erosion and sediment control practices**, with references to the standard details from the *Illinois Urban Manual* or the **US Army Corps of Engineers (Corps)** website.

Article 5: Requirements for Stormwater Management

The goal of Article 5 is to provide users with a complete understanding of the **stormwater runoff**, **volume control**, and **detention** requirements of the WMO and their applicability to different types of **development** in **Cook County**. This article includes the technical design criteria for **stormwater management systems**, including examples of calculations and computer modeling input/output.

Article 6: Flood Protection Areas

Article 6 provides guidance on the regulations of the WMO for **development** that involves **flood protection areas**, including **floodplains**, **floodways**, **wetlands/buffers**, and **riparian environments**. The goal of this article is to provide technical users with an understanding of the design and permitting requirements of the WMO and how they relate to each **municipality's NFIP** requirements, the **floodway** requirements of the **Illinois Department of Natural Resources – Office of Water Resources (OWR)**, the **floodplain** requirements of the **Federal Emergency Management Agency (FEMA)**, and the **wetland** requirements of the **Corps**.

Article 7: Requirements for Sewer Construction

This article provides design criteria for **qualified sewer construction** in **Cook County**, which also includes the construction of lift stations and/or forcemains. Example calculations, flow charts, and details are included which should provide technical users with a thorough understanding of the requirements for the construction of **sanitary sewers** in **Cook County**.

Article 8: Infiltration/Inflow Control Program

Article 8 provides guidance for **satellite entities** on meeting the requirements of the **District's** Infiltration/Inflow Control Program (IICP). This article contains background information and technical guidance pertaining to the IICP, and details the **satellite entities'** short-term and long-term responsibilities under the program. Sample completed forms, checklists, reporting requirements, and submittal schedules are included which should provide **satellite entities** and other technical users a clear understanding of the requirements of the IICP.

Article 9: Maintenance
Article 9 provides guidance on developing both short- and long-term maintenance plans for **erosion and sediment control practices**, **detention facilities**, **volume control facilities**, **stormwater management system** components, **qualified sewer construction**, **native planting conservation areas**, and **wetland** and **riparian environment mitigation** areas. Example performance standards for the planting of native vegetation are also included in this section.

Article 10: Inspections
The objective of this article is to provide users with a complete understanding of the various inspections that are required during each phase of **development**, and the responsible party for performing these inspections. The role of the developer, **authorized municipality**, and **District** is defined for each component of the **development**. Example inspection reports are also provided in this article.

Article 14: Administration
This article provides guidance for the **authorized municipality** program, WMO enforcement procedures, and the expected responsibilities of the **District**, **authorized municipalities**, **enforcement officers**, and **wetland specialists**. Article 14 lays out the necessary steps to become an **authorized municipality**, including a sample letter of intent and intergovernmental agreement. This article also discusses the applicability of the WMO in dual-county communities. Qualifications for becoming an **authorized municipality's enforcement officer**, as well as a **wetland specialist**, have also been addressed in this section.

Appendices
Additional useful information is provided in the appendices of the **TGM**. Appendix A contains definitions for all bold items found throughout the WMO and the **TGM**. Appendix B provides an inventory of all **Cook County Flood Insurance Rate Map (FIRM)** panels, organized by community. Appendix C contains many of the standard notes and details that will be required for **developments** permitted under the WMO. Appendix D provides a variety of useful resources for **satellite entities** to meet the requirements of the **District's** Infiltration/Inflow Control Program (IICP).

It is important to note that the **TGM** is based on the WMO as amended on July 10, 2014. Future revisions may contain requirements that supersede this version of the **TGM**. Users should always reference the most current version of the WMO.

ARTICLE 2. APPLICABILITY AND GENERAL PROVISIONS

ARTICLE SUMMARY

The goal of this article is to provide applicants with an understanding of the scope of regulation and the applicability of the WMO to proposed projects**.** Although the WMO applies to all **development** within **Cook County**, not every **development** will require a **Watershed Management Permit** from the **District**.

Guidance is provided for permitting applicability for the following special cases of **development**:

- Legacy **Sewerage System Permits** (SPO)
- **Single-family Home Developments**
- Direct Connections to **District** Facilities
- **Outfalls** to **Waterways** and Lake Michigan
- **Demolition**
- City of Chicago
- **Multi-County Municipalities**

Examples of permitting applicability can be found at the end of this Article.

The guidance provided in this Article includes references to some of the soil and **erosion** control requirements of Article 4, the **stormwater** provisions of Article 5, the **flood protection area** (FPA) requirements of Article 6, and **qualified sewer construction** in Article 7. This is not intended to be a comprehensive overview of these requirements, but just a reference to further understanding the overall requirements of the WMO. Please refer to the respective Articles of the WMO and **TGM** for in depth guidance regarding these requirements.

NOTE: All bold words are defined in Appendix A of the WMO and the TGM.

§200. SCOPE OF REGULATION

The WMO applies to all **development** within **Cook County**, as well as all **qualified sewer construction** within the **District's** corporate boundaries and service agreement areas, which includes **development** under the control of any governmental entity, agency, or authority. However, not every **development** within **Cook County** will require a **Watershed Management Permit** from the **District**.

EXEMPTIONS

As specified in §200.4 of the WMO, the provisions of the WMO do not apply to any of the following:

A. Agriculture and gardening activities that do not involve filling, grading, or construction of levees.

   Agricultural and gardening activities are exempt from the WMO. Mass grading of agricultural land for the purposes of eventual sale or non-agricultural use is considered **development** and is subject to WMO requirements.

B. **Structures** and land uses existing as of May 1, 2014 (the effective date of the WMO), except when **redevelopment** occurs.

   WMO requirements do not retroactively apply to **parcels** in **Cook County** that were developed prior to May 1, 2014. However, **development** or **redevelopment** of any **parcel** within the **District's** jurisdiction after May 1, 2014, is subject to the WMO requirements.

C. **Development** within the corporate boundaries of the City of Chicago, Illinois, except for the below three scenarios. In these cases, a **Facility Connection Authorization** (FCA) is required in lieu of a full **Watershed Management Permit**, and additional easement and leasing requirements may also apply. An FCA is required for any of the following:

   1) New or reconstructed **outfalls** to **waterways** or Lake Michigan;

      Requirements for **outfalls** apply throughout **Cook County**, including areas that may be exempt from some provisions of the WMO, such as the City of Chicago.

   2) **Stormwater** discharges directly to **District** property;

      Stormwater discharges include direct discharge from an adjacent **parcel**, as well as grading or **development** changes that impact **stormwater runoff** on the **District's** property.

   3) Direct connections to **District** interceptors, **TARP structures**, facilities, or **District** property.

      These **District** impacts require notification and permitting from several departments within the **District**, which is facilitated by obtaining an FCA.

D. **Development** activities listed in §201.1 of the WMO that are within the corporate boundaries of a **multi-county municipality**, which has adopted and currently enforces the **stormwater ordinance** of a **contiguously** adjacent Illinois county subject to the requirements of §207 of the WMO.

Multi-county municipalities are not automatically exempt from **Watershed Management Permits** for the **stormwater** and **flood protection area** (FPA) **development** activities found in §201.1. In order to obtain this exemption, the **municipality** must submit a letter of intent (LOI) and enter into an intergovernmental agreement (IGA) with the **District**, which indicates the **municipality** will follow all provisions of §207 and will enforce the adjacent county's **stormwater** ordinance. A template LOI and IGA can be found at wmo.mwrd.org. Additional information on **multi-county municipalities** can be found below under "Special Cases of **Development**".

E. **Development** activities listed solely in §201.1 of the WMO that are undertaken by state or federal agencies (e.g. **IDOT**, Illinois Tollway Authority, or the **Corps**).

Watershed Management Permits are still required for **development** activities listed in §201.2 of the WMO. These include **qualified sewer construction**, new or reconstructed **outfalls** to **waterways** or Lake Michigan, modifications to the storage volume, outlet **structure**, or **tributary area** of a **District** permitted **detention facility**, and impacts to **District** owned infrastructure or land.

F. **Development** activities listed solely in §201.1 of the WMO that are undertaken as a **flood control project**.

Refer to the guidance given in Part E, above.

G. **Development** undertaken by the **District**.

District projects are either **flood control projects** or infrastructure rehabilitation and improvements to **District** owned facilities. **Flood control projects** are exempt from the **stormwater** provisions of the WMO, and historically, the **District** has never issued permits for its own sewer or infrastructure work.

§201. APPLICABILITY

GENERAL APPLICABILITY REQUIREMENTS

Development activities have the potential individually, or in the aggregate, to cause an increase in **flood** damage on a regional basis and therefore are regulated through the permit process of the WMO. It should be noted that **developments** outlined in §201.1 may be permitted through either the **District** or an **authorized municipality**, but approval for **developments** outlined in §201.2 can only be issued by the **District**. Table 1 of the WMO provides a more detailed summary of the appropriate permitting authority for various **development** activities.

If a **Watershed Management Permit** is required, all Articles of the WMO apply (3 through 14). The **development** area is subject to the **stormwater** provisions listed in Table 2 of Article 5. Depending on the size of the **contiguous ownership interest**, **runoff** and detention is required for the entire **development** area, and volume control is required for the proposed **impervious area** of the **development**, regardless of existing conditions. More information on **stormwater** thresholds can be found in Article 5 of the WMO and this **TGM**.

If a permit is not required, then volume control is not required. Detention is required if the **contiguous ownership interest** meets the thresholds listed in Table 2, but may be deferred until the aggregate **development** area exceeds 0.50 acre.

Applicability requirements for **Watershed Management Permits** are generally categorized into two divisions: (1) **flood protection areas** and **development** (§201.1), and (2) **qualified sewer construction** and **District** impacts (§201.2).

§201.1 FLOOD PROTECTION AREAS AND DEVELOPMENT

With regards to §201.1, a **Watershed Management Permit** is required for any **development** that meets the following:

A. The **development** is within a **Flood Protection Area** (§201.1.A of the WMO). Any disturbance meeting the definition of **development** must obtain a permit, regardless of the size of the disturbance.

   Flood protection areas include:

   - **Regulatory floodplains** (§601 and §602)
   - **Regulatory floodways** (§601 and §602)
   - **Riparian Environments** (§606 and §607)
   - **Wetlands** (§603 and §604)
   - **Wetland Buffers** (§603 and §604)

Parcels that are shown to be within the **regulatory floodplain** or **regulatory floodway** according to **FEMA** maps, but have been removed by **FEMA** via a **LOMA**, **LOMC**, **LOMR**, or **LOMR-F**, may demonstrate this provision does not apply by providing the appropriate documentation to the **District**.

B. The **development** indirectly impacts a **wetland** (§201.1.B of the WMO).

Indirect wetland impacts are defined as **development** that causes the **wetland hydrology** to fall below eighty percent (80%) or exceed one-hundred fifty percent (150%) of the existing condition **storm event runoff** volume to the **wetland** for the 2-year, 24-hour **storm event**.

C. The **development** of a residential **building** within 100-feet of the **regulatory floodplain**, excluding non-**substantial improvements** to **single-family homes** (§201.1.C of the WMO).

Consistent with the purpose of the WMO, as indicated in §103.1, this provision protects public health, safety, and welfare, and reduces the potential for loss of property due to **flood** damage. Residential **buildings** located near the FPA are specifically targeted due to their nature as a habitable **structure**.

D. The **development** disturbs more than 0.50 acres, unless the **development** solely involves one or more of the following (§ 201.1.D 1-4 of the WMO):

1) Installation, renovation, or replacement of a septic system, potable water service line, or other utility to serve an existing **structure**, provided that the area is restored to existing grade, and vegetative cover is restored.

   Septic systems are not considered qualified sewer and are not regulated by the **District**. Local requirements, including those of the Cook County Department of Public Health, govern these systems, and all local approvals shall be obtained prior to **start of construction**. Non-sewer utilities serving the **structure** may be constructed, relocated, or replaced without requiring a **Watershed Management Permit** as long as all areas are restored.

2) Excavation in public **rights-of-way** or utility easements outside of **flood protection areas** for the purpose of installing or maintaining utilities other than **qualified sewer construction**, provided that the area is restored to existing grade, and vegetative cover is restored.

   Non-sewer public utilities may be constructed, relocated, or replaced without requiring a **Watershed Management Permit** as long as all areas are restored and there is no impact to a **flood protection areas**. The installation of drainage **structures** in a previously unsewered area is considered **development**, and is not exempt from permitting requirements under this provision.

3) **Maintenance**, repair, or at-grade, in-kind replacement of existing lawn areas not otherwise requiring a **Watershed Management Permit**, provided that the area is restored to existing grade, and vegetative cover is restored.

Pervious areas that are replaced in-kind, without drainage improvements or a change in use, are considered **maintenance** and are not subject to the **development** and **stormwater** requirements of the WMO. While **maintenance** is considered to be within the **disturbed area**, it is excluded from the **development** area.

Examples of pervious-to-pervious activities that are <u>NOT</u> considered **maintenance** may include, but are not limited to:

- Constructing a berm, pond, or mass grading a **site** – change in drainage pattern.
- Installing pervious pavers in a former grass area – pervious replacement is not in-kind.
- Constructing a new playground with pervious rubber surface in an existing pervious area – change in use.
- Replacing a grass field with synthetic turf – change in drainage (different **runoff** coefficient).
- Installing structural grass to convert a landscaped area to parking – change in use. ***Note:*** *Installing structural grass to improve an existing grass parking area may be considered* ***maintenance****, since there is no change in use.*

4) **Maintenance**, repair, or in-kind replacement of existing **impervious areas** including, but not limited to, roadways or parking lots not otherwise requiring a **Watershed Management Permit**.

Impervious areas that are replaced in-kind, without drainage improvements or a change in use, are considered **maintenance** and are not subject to the **development** and **stormwater** requirements of the WMO.

Examples of impervious-to-impervious activities that are <u>NOT</u> considered **maintenance** may include, but are not limited to:

- Installing drainage **structures** or **storm sewers** in an existing parking lot – change in drainage pattern.
- Constructing a curb around an existing **impervious area** that results in modifying **site stormwater runoff** – change in drainage pattern.
- Installing pervious pavers in an existing **impervious area** – permeable pavers are considered pervious; therefore, replacement is not in-kind and changes the drainage pattern.
- (1) Constructing a **building** on existing **impervious area**, (2) Demolishing a **building** and paving the demolished area, (3) Constructing a basketball court on an existing park/soccer field/parking lot, etc. – change in use.
- Demolishing a **building** and installing a new **building** in the same footprint – new **buildings** are not considered **maintenance activities**.

> ***Note:** While **demolition** is not considered **maintenance**, it is also not considered **development** under the WMO. Additional information on **demolition** can be found below under "Special Cases of **Development**".*

Items 1 through 4 above represent disturbances that are not considered to negatively impact the **watersheds** of **Cook County** on a regional basis. However, it is important to note the following:

- A local permit from the **municipality** may still be required for these activities, and all local, regional, state, and federal permits must be obtained prior to **start of construction**;
- If the activity is located in a **Flood Protection Area**, a permit is required regardless of the size of the **development** area; and
- Adequate **erosion** and **sediment** measures are required for the development, as the **erosion** and **sediment** provisions of the WMO still apply regardless of whether a **Watershed Management Permit** is required.

If not already required for another reason, any **development** greater than 0.50 acres requires a **Watershed Management Permit** and is subject to the **stormwater** provisions of Article 5 as indicated in Table 2 of that Article.

§201.2 QUALIFIED SEWER CONSTRUCTION AND DISTRICT IMPACTS

With regards to §201.2, a **Watershed Management Permit** is required for any **development** that meets the following:

A. The **development** proposes sewers, drainage, or detention in **combined sewer areas** tributary to **combined sewers** or a **waterway** (§201.2.A of the WMO);

   All **stormwater** within the **combined sewer area** has the potential to flow to **District** facilities. The **District** considers all **storm sewers** in these areas to be **qualified sewer construction**, even when tributary to a **waterway**.

B. The **development** proposes **qualified sewer construction** within the **District's** corporate boundaries or service agreement areas (§201.2.B of the WMO).

   Qualified sewer includes all **sanitary sewers**, and **storm sewers** within the **combined sewer area**, even if tributary to a **waterway**, as well as **storm sewers** in a **separate sewer area** that are directly or indirectly tributary to a **District** facility. Repair and rehabilitation of sewers, manholes, and other appurtenances is also considered under this provision. A list of what is and is not considered **qualified sewer construction** is found in §701 of the WMO and Article 7 of this **TGM**. These sewers also require permits when remaining work falls under the exemption provisions of §200.4, such as **flood control projects** or projects undertaken by state or federal agencies.

Qualified sewer construction is not always accompanied by **development**, and could potentially utilize a simpler method for obtaining a **Watershed Management Permit**. Depending on the scope of work, the **Watershed Management Permit** that is required may either be a full permit, a Notification and Request for Inspection (NRI), or a **Facility Connection Authorization**. Further information on the various permit types that are considered **Watershed Management Permits** can be found in Article 3 of this **TGM**.

C. The **development** proposes a direct connection to a **District** interceptor, reservoir, facility, or **TARP structure** (§201.2.C of the WMO).

Permits are always required when direct connections to **District** infrastructure are proposed, even if the work falls under the exemption provisions of §200.4, such as **flood control projects** or projects undertaken by state or federal agencies. A preliminary coordination meeting with the **District** is recommended for these types of projects. The WMO specifies a formal petition to the **Director of Engineering** shall be requested in writing, which may be accomplished via letter or email to the **District's** Local Sewer Systems Section. Requirements for direct connections to **District** infrastructure can be found in §702.2.F of the WMO and Article 7 of this **TGM**.

D. The **development** proposes new or reconstructed **outfalls** to **waterways** or Lake Michigan, within **Cook County** (§201.2.D of the WMO).

A **Watershed Management Permit** is required for all proposed **outfalls** and reconstruction of existing **outfalls** within the boundary of **Cook County**. Reconstruction of **outfalls** includes activities such as in-kind replacement, adding wing walls, extending the pipe, relocation, etc. **Maintenance** of **outfalls** that is limited to grouting, patching, sealing, or other activities that do not modify or replace any **structure** or piping does not require a permit.

Outfall is defined in Appendix A of the WMO and this **TGM**, and includes all public and private sewers, but excludes private **single-family home** drains.

E. The **development** proposes reconfiguration of existing **major stormwater systems** or **minor stormwater systems** which alters the service area of a **District** permitted **detention facility** (§201.2.E of the WMO).

Altering the **tributary area** of a **detention facility** has potential to change the volume, high water level, or release rate. In the case of **detention facilities** permitted by the **District**, the volume, high water level, and release rate are regulated under the permit and must be maintained until such time as a new permit or permit revision supersedes the original. This provision applies to all **detention facilities** permitted by the **District**, regardless if the permit was issued under the **Sewer Permit Ordinance** (SPO) or the WMO. See §104 of the WMO for provisions regulating the relationship between the WMO and the SPO.

F. The **development** proposes modifications to the outlet control **structure** or storage volume of a **District** permitted **detention facility** (§201.2.F of the WMO).

The volume, high water level, and release rates of **detention facilities** permitted by the **District** are regulated under the permit and must be maintained until such time as a new permit or permit revision supersedes the original. This provision applies to all **detention facilities** permitted by the **District**, regardless if the permit was issued under the **Sewer Permit Ordinance** (SPO) or the WMO. See §104 of the WMO for provisions regulating the relationship between the WMO and the SPO.

The prior two permitting requirements do not apply to **existing detention facilities** that were constructed under an SPO permit, but were not required by the **District** (i.e. locally required). However, locally required **detention facilities** that are being used toward WMO detention requirements must meet the **redevelopment** provisions of §505 of the WMO and submit Schedule D-Legacy with the WMO Permit application. Additional details can be found in Article 5 of this **TGM**.

G. The **development** discharges **stormwater** directly to **District** property (§201.2.G of the WMO).

Hydraulic improvements, point discharges, and sheet flow within or onto **District** property is covered by this provision. Any **development** proposed on **District** land will require a **Watershed Management Permit**, as well as potential lease or easement requirements from the **District's** Law Department. The Real Estate Division of the Law Department can be reached at (312) 751-6557 for additional information regarding requirements for leasing and developing **District** property.

H. **Non-residential developments** on septic systems or private treatment systems that propose a connection to a **sanitary sewer** (§201.2.H of the WMO).

Parcels with existing septic or private treatment systems that wish to connect to the public **sanitary sewer** must obtain a **Watershed Management Permit** prior to making the connection. This requirement does not apply to **single-family home service sewers**.

Figure 2.1 provides a flowchart to assist applicants with determining if a **Watershed Management Permit** will be required for a particular **development**. This flow chart and the supplemental flow charts regarding requirements for **stormwater**, **flood protection areas**, **qualified sewer construction**, and **District** impacts can all be found at the dedicated WMO website, wmo.mwrd.org.

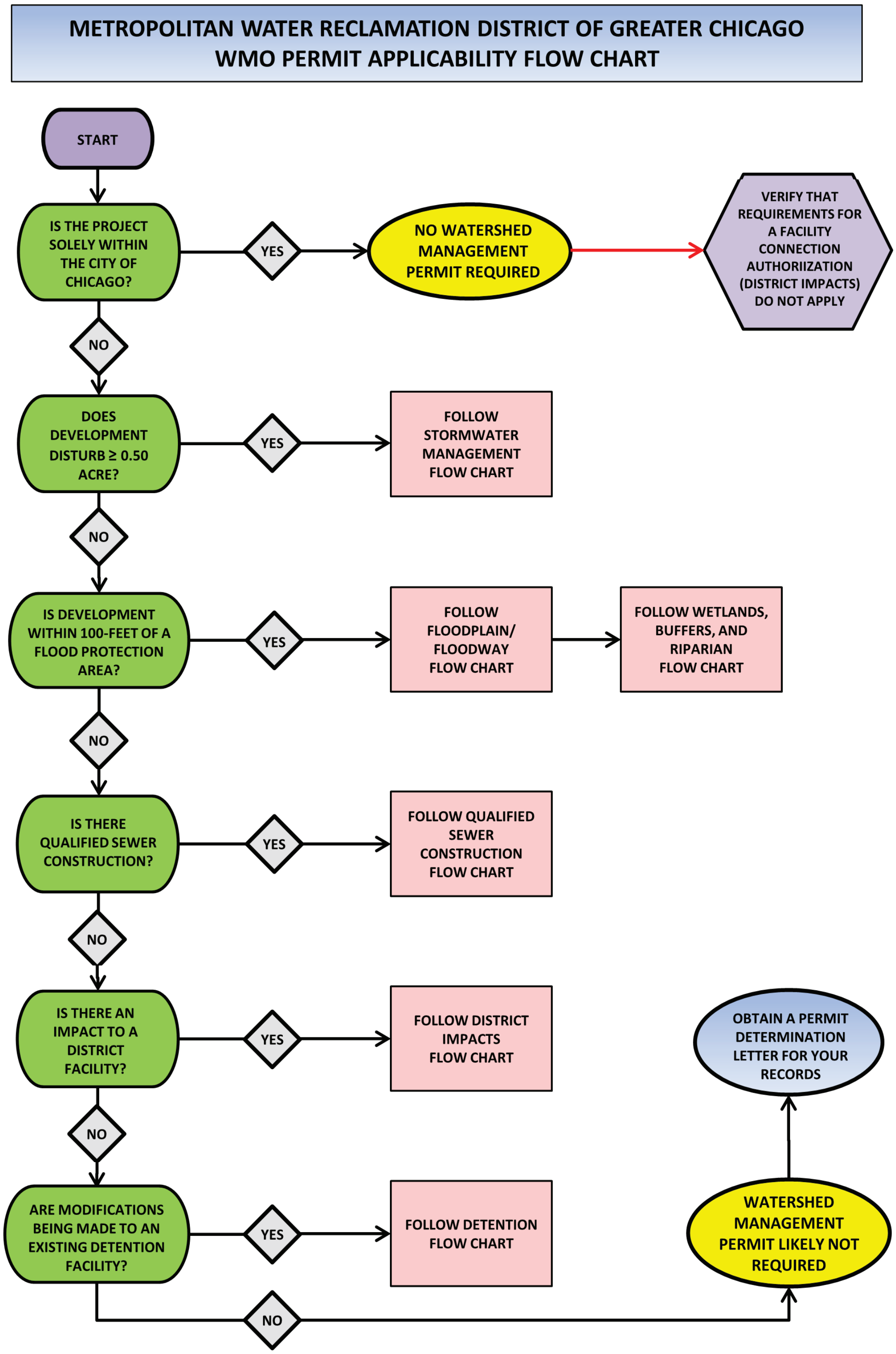


Figure 2.1 Watershed Management Permit Applicability Flowchart

SPECIAL CASES OF DEVELOPMENT

It is important to note that for some **developments**, only certain portions of the project may be regulated under the WMO. These special cases, along with an explanation of why certain activities are regulated by the **District**, are provided in the following sections:

LEGACY SEWERAGE SYSTEM PERMITS (SPO)

The provisions of the WMO do not retroactively apply to **developments** that have obtained approval from the **District** under the **Sewer Permit Ordinance** (SPO), unless **redevelopment** is occurring on these **parcels**. In such cases, the WMO provides **stormwater** detention allowances for **parcels** that contain **existing detention facilities**. **Redevelopment** provisions are found in §505 of the WMO and Article 5 of this **TGM**.

SINGLE-FAMILY HOME DEVELOPMENTS

The WMO is not intended to regulate **single-family homes**, but since it regulates all **development** within **flood protection areas** (FPAs) and residential **buildings** within 100-feet of the **regulatory floodplain**, a **Watershed Management Permit** will be required under these circumstances. Since **development** in **FPAs** can have a significant effect on public quality of life, it is vital that a new home is properly elevated to the Flood Protection Elevation (**FPE**). It should be noted that **single-family home developments** are exempt from the **stormwater runoff**, **volume control**, and **detention** requirements of the WMO.

It should also be noted that the above only applies to new **single-family homes** or those proposing a **substantial improvement**, and the **District** does not determine what constitutes a **substantial improvement**. This determination is made by the local **municipality** in accordance with **NFIP** regulation.

For **single-family homes** that require a permit, the applicant is not required to make a full **Watershed Management Permit** submittal unless the construction includes a public **sanitary sewer** extension to serve the **parcel** or impacts a **wetland** or **riparian environment**. Instead, a **Special Flood Hazard Area** (SFHA) short-form permit, along with supporting documentation, may be submitted to the **District**. Further information on the various **Watershed Management Permits** types can be found in Article 3 of this **TGM**.

DIRECT CONNECTIONS TO DISTRICT FACILITIES

Any **development** that proposes a direct connection to **District** interceptors, reservoirs, facilities, or **TARP structures** will require a **Facility Connection Authorization** (FCA) within the City of Chicago or a **Watershed Management Permit** within the remainder of the **District's** service boundary. Because these connections impact the **District's** infrastructure, it is crucial that

District approval is obtained for these projects. All projects, regardless of project size, location, or applicant, shall obtain **District** approval.

While adjustments to **District structures** due to roadway or other **right-of-way** improvement do not require a **Watershed Management Permit**, authorization may be obtained by contacting the **District's** Maintenance and Operations staff at (708) 588-4319 prior to performing this work.

OUTFALLS TO WATERWAYS AND LAKE MICHIGAN

All new and reconstructed **outfalls** to **waterways** and Lake Michigan within **Cook County** require a **Watershed Management Permit**. **Outfalls** located within the City of Chicago will require an FCA from the **District**. These types of projects do not require **stormwater detention**, although a water quality interceptor is required as part of the **outfall** plan if tributary to Lake Michigan. A standard detail can be found in Appendix C of this **TGM**.

DEMOLITION

In general, **demolition** is not considered **development** under the WMO. However, certain aspects related to **demolition** activities could be considered **development**, depending on the scope of work.

The following examples provide guidance on **demolition** activities and permitting requirements.

EXAMPLE 1: WAREHOUSE DEMOLITION WITH NO SITE WORK

An old warehouse is being demolished, slab removed, and area will return to a vacant and natural state. There is no site grading or landscaping proposed.

In this case, a Watershed Management Permit is not required because there is no development.

EXAMPLE 2: PLAYGROUND DEMOLITION ON EXISTING PARK LAND

A playground area within an existing park is being removed and relocated to a different area of the park. The demolished area will be reseeded with grass.

In this case, the demolished playground area will <u>not</u> be considered development, but the new playground area will.

EXAMPLE 3: BUILDING DEMOLITION WITH FOUNDATION PAD REMAINING

The roof and walls of an old building are being demolished and the remaining foundation pad will be used as a parking lot.

In this case, the change in use of the impervious area from a foundation pad to a parking lot is considered development and is subject to WMO requirements.

EXAMPLE 4: SITE DEMOLITION WITH GRADING AND LANDSCAPE BERMS

The entire site is being demolished. The site will be graded in anticipation of future sale to a developer, and landscape berms will be installed as a beautification measure.

In this case, both the site grading and the landscape berms are considered development, and all work is subject to WMO requirements.

CITY OF CHICAGO

Although the **stormwater** provisions of the WMO do not apply to projects located within the City of Chicago, certain **developments** will require **District** approval. Any **development** located within the City of Chicago that proposes a direct connection to **District** interceptors, facilities, property, or **TARP structures**, or new or reconstructed **outfalls** to **waterways** or to Lake Michigan shall obtain a **Facility Connection Authorization** (FCA).

MULTI-COUNTY MUNICIPALITIES

The WMO provides the option for **multi-county municipalities** that have entered into an IGA with the **District** to adopt and enforce the adjacent county's **stormwater** ordinance, if the community meets the conditions provided in §207 of the WMO. A **Watershed Management Permit** from the **District** would not be required for **developments** in these **municipalities**, unless the **development** includes activities specified in §201.2 of the WMO, with the exception of detention related activities in §201.2.E and §201.2.F. However, in an effort to maintain accurate records, a letter documenting any changes to **District** permitted **detention facilities** should be sent to the **District** at:

Metropolitan Water Reclamation District
Local Sewer Systems Section
111 East Erie Street
Chicago, IL 60611

Examples of permit applicability for **developments** within a **multi-county municipality** may include, but are not limited to, the following:

EXAMPLE 1: QUALIFIED SEWER CONSTRUCTION AND FLOOD PROTECTION AREAS

Municipality has adopted adjacent county's ordinance and entered into an IGA with the District. Proposed development is greater than 0.50 acre with qualified sewer construction. Floodplain and wetlands are being impacted.

A Watershed Management Permit is required for qualified sewer construction only. Work in the FPA is subject to the provisions of the adjacent county's ordinance.

EXAMPLE 2: MODIFICATIONS TO A DISTRICT PERMITTED DETENTION FACILITY

Municipality has adopted adjacent county's ordinance and entered into an IGA with the District. Proposed development includes modifying a District permitted detention facility to meet adjacent county's standards, and constructing single-family homes in a previously sewered subdivision. Additional qualified sewer construction is not proposed.

Single-family home service sewers are not considered qualified sewer construction. A Watershed Management permit is not required for any portion of the proposed development. All development must meet the provisions of the adjacent county's ordinance. A letter documenting the changes to the District permitted detention facility should be sent to the Local Sewer Systems Section of the District.

EXAMPLE 3: MUNICIPALITY HAS NOT ENTERED INTO AN IGA WITH THE DISTRICT

Municipality has adopted adjacent county's ordinance, but has not entered into an IGA with the District.

A Watershed Management Permit is required per all provisions of the WMO. A multi-county municipality must enter into an IGA with the District to enforce the adjacent county's ordinance in lieu of the WMO within the Cook County portion of their municipal boundary.

ARTICLE 2. GENERAL APPLICABILITY EXAMPLES

The following examples illustrate permit applicability for some typical **development** situations. A high level overview of **stormwater** requirements, as outlined in Article 5, Table 2 of the WMO, is included. It should be noted, these examples do not represent all cases, and are provided for illustrative purposes only. Actual projects may differ or may include additional factors that alter the permitting requirements for the specific project.

Every project should be evaluated separately to determine if a **Watershed Management Permit** is required. Permit Determinations can always be requested by mailing a letter describing the project, and including exhibits or plans showing the scope of work, to:

Metropolitan Water Reclamation District
Local Sewer Systems Section
111 East Erie Street
Chicago, IL 60611

EXAMPLE 1: BUILDING RENOVATION WITH NEW SANITARY SEWER CONNECTION

Parcel area = 3.5 acres. Scope of work includes interior building renovation with a new sanitary sewer connection. No other development is proposed.

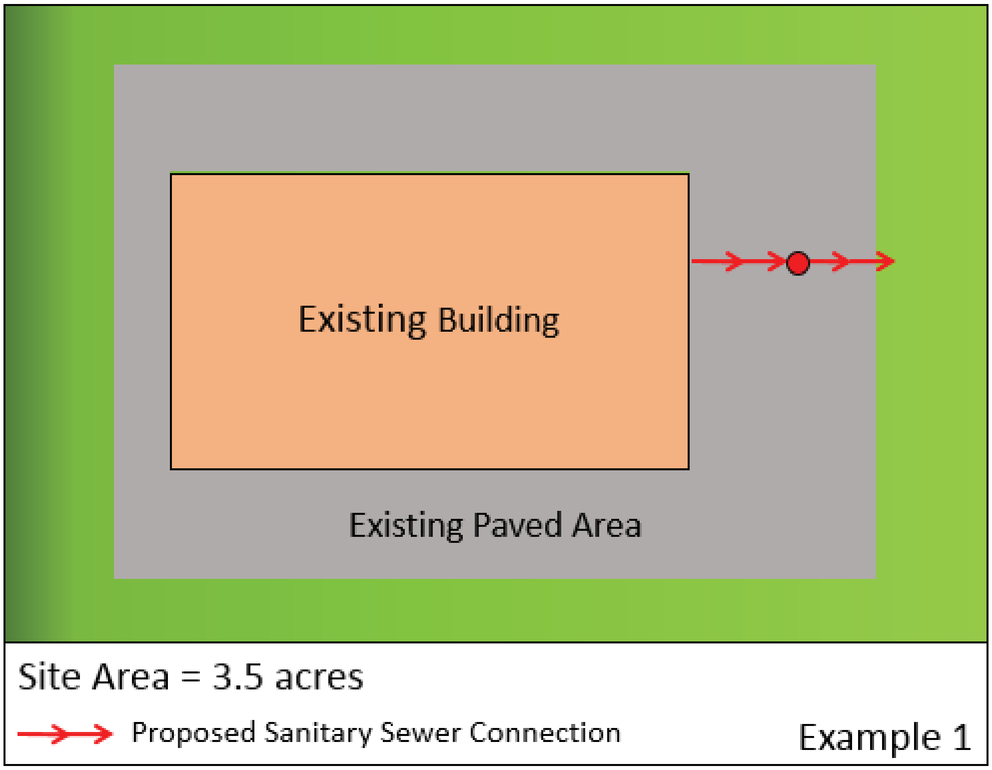


Figure 2.2 Permit Applicability Example 1

Interior building renovations are not considered development under the WMO. Any interior sewer work is considered plumbing and is regulated by the local authority. Exterior sewer work, occurring at the building envelope and beyond, is considered qualified sewer construction. Since qualified sewer construction is proposed, a Watershed Management Permit is required. The stormwater provisions of Article 5 do not apply, as there is no development area.

Note: Demolition and reconstruction of a building is a "new building", and would be considered development, which is subject to the stormwater provisions of Article 5.

EXAMPLE 2: NEW PARKING LOT ON EXISTING DEVELOPED PARCEL

Parcel area = 2.5 acres in a combined sewer area, of which 1.75 acres is existing impervious and 0.75 acre is unimproved pervious. Scope of work includes developing the 0.75 acre pervious to impervious parking lot with overland flow and no sewers.

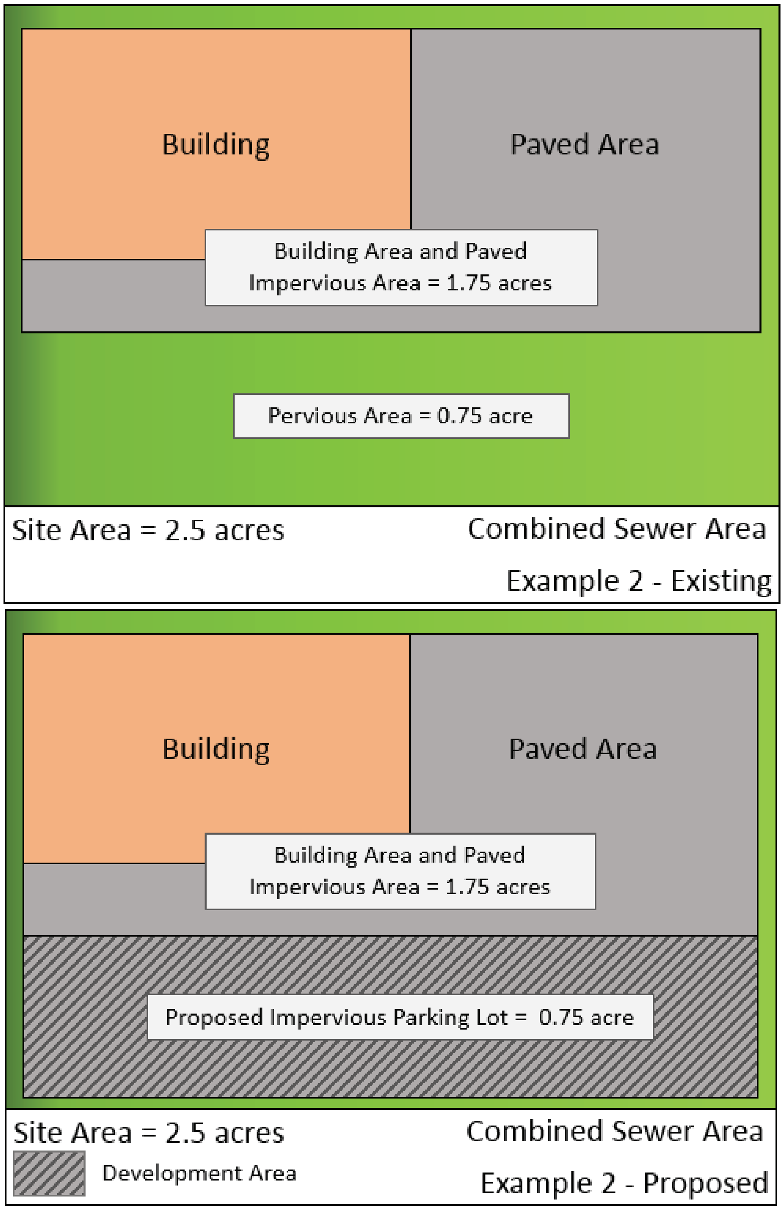


Figure 2.3 Permit Applicability Example 2 – Existing and Proposed Conditions

Since total development area is greater than 0.50 acre, a Watershed Management Permit is required. Because the non-residential parcel is greater than 0.50 acre, the stormwater provisions of Article 5 apply. Runoff and volume control are required for the development area. If the contiguous ownership interest had exceeded 3.0 acres, detention would have also been required.

EXAMPLE 3: NEW PARKING LOT ON PARCEL WITH EXISTING DETENTION FACILITY

Parcel area = 3.2 acres in the separate sewer area, of which 2.45 acres is developed and 0.75 acre is undeveloped. Scope of work includes developing 0.65 acre of the undeveloped land into paved parking lot with new storm sewers.

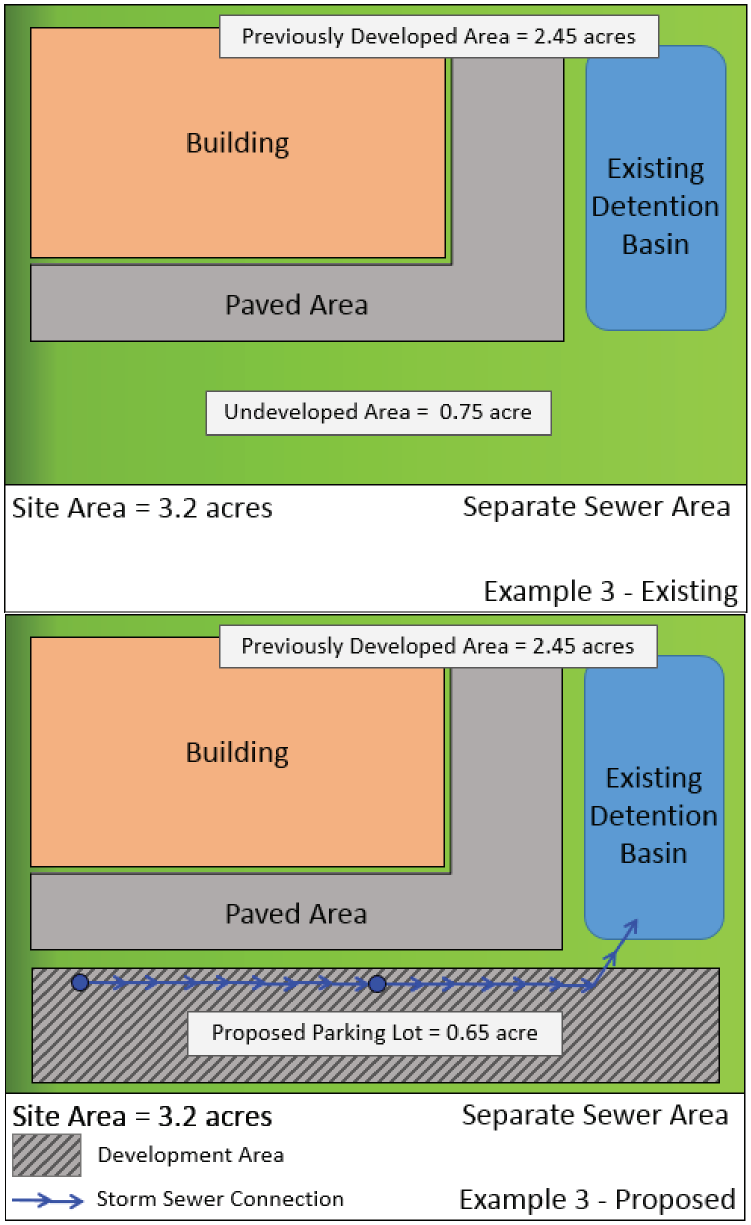


Figure 2.4 Permit Applicability Example 3 – Existing and Proposed Conditions

Since the total development area is greater than 0.50 acre, a Watershed Management Permit is required. The stormwater provisions of Article 5 of the WMO apply, and runoff, volume control, and detention are required. Since detention already exists, the redevelopment provisions of §505 of the WMO and Schedule D-Legacy may be used toward meeting detention requirements.

EXAMPLE 4: PARKING LOT DRAINAGE SYSTEM INSTALLATION

Parcel area = 2.5 acres in a combined sewer area, of which 1.75 acres is existing impervious and 0.75 acre is unimproved pervious. The pervious area will remain undeveloped; however, storm sewers are installed in an existing 0.30 acre impervious parking lot.

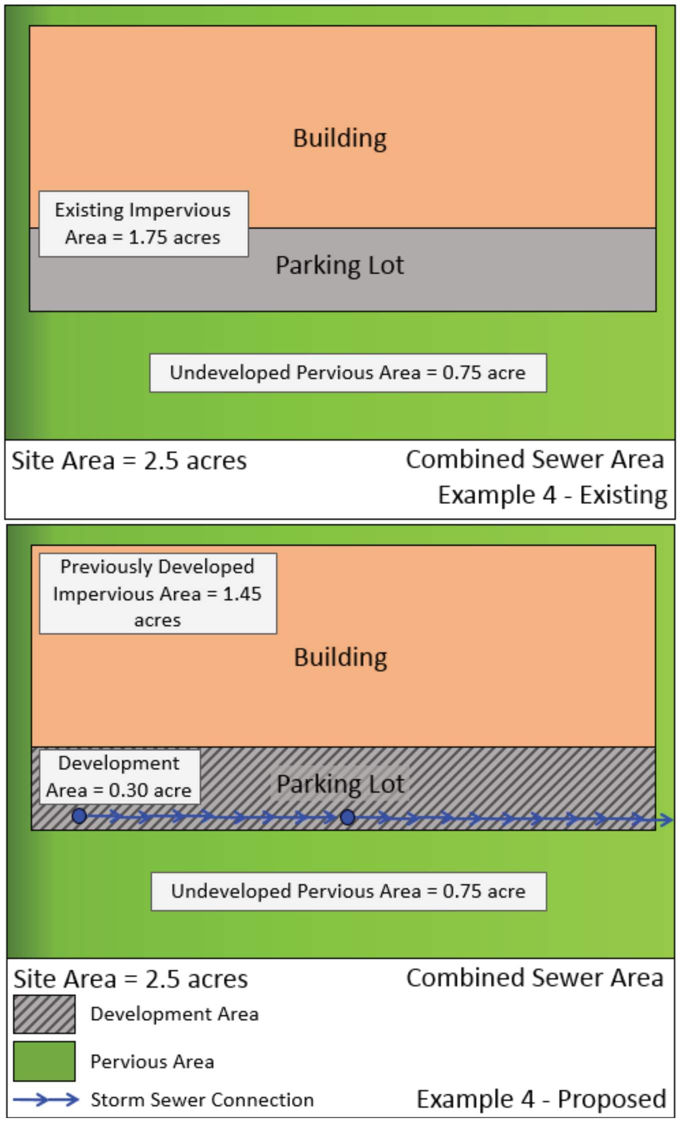


Figure 2.5 Permit Applicability Example 4 – Existing and Proposed Conditions

Storm sewers added to an existing unsewered area is considered development. Total development area is less than 0.50 acre, which would not require a permit on its own. However, since storm sewer is being installed within the combined sewer area, it is considered qualified sewer construction. Since a Watershed Management Permit is required, the stormwater provisions of Article 5 of the WMO apply. As indicated in Article 5, Table 2, runoff and volume control are required due to the ownership interest of the non-residential parcel exceeding 0.50 acre. Detention is not required unless contiguous ownership interest is greater than 3.0 acres.

EXAMPLE 5: PARKING LOT EXPANSION WITH STORM SEWER IN THE SEPARATE SEWER AREA

Parcel area = 3.2 acres in the separate sewer area, of which 2.45 acres is developed and 0.75 acres is undeveloped. Scope of work includes developing the 0.25 acres into paved parking lot with new storm sewers.

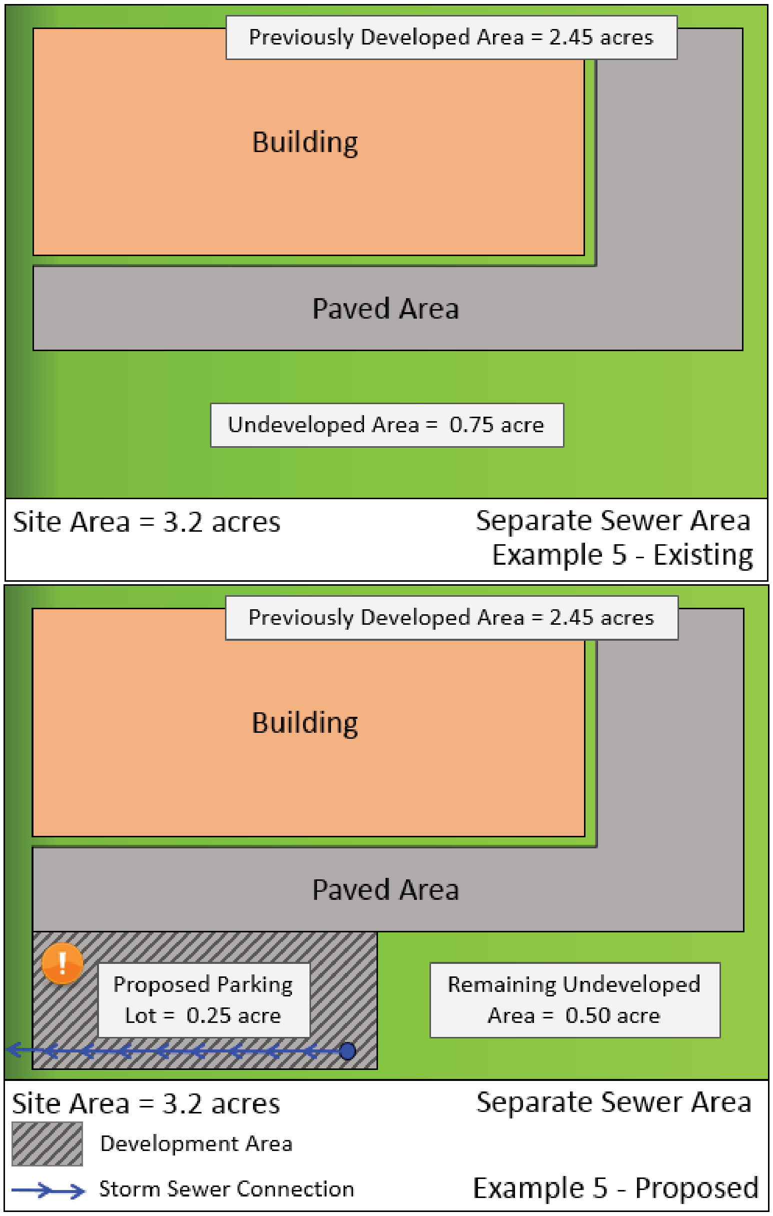


Figure 2.6 Permit Applicability Example 5 – Existing and Proposed Conditions

Since the total development area is less than 0.50 acre, a Watershed Management Permit is not required. Detention is required, but may be deferred until the aggregate development area (!) exceeds 0.50 acre. Total aggregate on this parcel is 0.25 acre. At such time as a Watershed Management Permit is required, the detention design must include this 0.25 acre area along with the development area of the project proposed under that permit.

TGM ARTICLE 2 REVISION TABLE

No.	Revision Description	Date
0	Original TGM	5/1/2014
1	Remove EDPL, update flow charts, include SFH permits	8/1/2015
2	Revision table, Amendment edits, rewrite	3/20/2018

ARTICLE 3. WATERSHED MANAGEMENT PERMIT REQUIREMENTS AND SUBMITTALS

ARTICLE SUMMARY

This section provides guidance on obtaining a **Watershed Management Permit** from the **District** or an **authorized municipality**. The following are the various types of **Watershed Management Permits** that may be obtained:

- Regular **Watershed Management Permit** (WMO Permit)
- Earthwork/Foundation Limited Permit (Earthwork Permit)
- **Single Family Home** – **Special Flood Hazard Area** Permit (SFHA Permit)
- Notification and Request for Inspection (NRI)
- **Facility Connection Authorization** (FCA)
- Permit Revision

These permit types and their applicability will be further discussed in the "**Watershed Management Permit** Types" section of this Article of the **TGM**.

The guidance provided in this Article includes general submittal requirements for **Watershed Management Permits**, as well as specific requirements relating to supplemental submittal packages. Requirements for the appropriate permit Schedules, signatures, plan sheets, exhibits, fees, revisions, construction timeline, and record drawings are also included. The specific submittal packages covered under this Article are as follows:

- **Erosion** and **Sediment** Control
- **Stormwater** Management
- **Floodplain**
- **Wetland**
- **Riparian Environment**
- **Qualified Sewer Construction**
- **Maintenance** and Monitoring Plan

NOTE: All bold words are defined in Appendix A of the WMO and the TGM.

WATERSHED MANAGEMENT PERMIT TYPES

The following sections outline the different **Watershed Management Permit** types and specific requirements for each. All **Watershed Management Permits** must be submitted with original signatures and applicable fees to:

Metropolitan Water Reclamation District
Local Sewer Systems Section
111 East Erie Street, 6th floor
Chicago, IL 60611

For **developments** located within an **Authorized Municipality**, the **Watershed Management Permit** must be submitted to the **Authorized Municipality** for review and coordination with the **District**. **Watershed Management Permit** applications and supplemental permit forms can be found on the **District's** WMO website, at wmo.mwrd.org.

WMO PERMIT

A regular **Watershed Management Permit** (WMO Permit) is the most common permit type and may be issued by either the **District** or an **Authorized Municipality** (**Authorized Municipalities** are discussed in Article 14 of this **TGM**.) The WMO Permit must be signed and sealed by a registered **Professional Engineer** to indicate the technical submittal meets the design criteria contained in the WMO. The supplemental permit forms (Schedules) are listed on Page 1 of the WMO Permit application and provide an outline of the applicable permitting requirements for a **development**. Not all Schedules are required for every permit, and will vary depending on the individual project. The Schedules are described as follows:

GENERAL REQUIREMENTS:

- Schedule A – Project Information
- Certifications and Signatures

SOIL EROSION AND SEDIMENT CONTROL (ARTICLE 4):

- Schedule P – Soil Erosion and Sediment Control
    - Not required for projects that only include utility installation.

STORMWATER MANAGEMENT (ARTICLE 5):

- Schedule D – Detention and Stormwater Management Facilities (WMO)
    - Required for runoff, volume control, and **detention facilities** meeting the design standards of, or modifying facilities designed to the standards of §504 of the WMO

- Schedule D_{Legacy} – Detention and Stormwater Management Facilities (Legacy)
  - ➢ Required for runoff, volume control, and when **existing detention facilities**, constructed prior to the WMO (May 1, 2014), are being utilized to meet detention requirements, per §505
- Schedule K – Affidavit of Disclosure of Property Interests
  - ➢ Includes Exhibit A – Current Survey of Property Interests (Plat of Survey)
  - ➢ Two notarized copies with original signature required
  - ➢ Schedule K is not required for projects in the public **right-of way** (ROW) and is only required for projects that are below the **parcel** ownership area thresholds which require detention, as provided in Table 2 of the WMO.
- Schedule L – Notice of Requirements for Stormwater Detention
  - ➢ Includes Exhibit A – Current Survey of Property Interests (Plat of Survey)
  - ➢ Applicable for **sites** in which detention has not previously been provided for at least 0.50 acre of undeveloped area

FLOOD PROTECTION AREAS (ARTICLE 6):

- Schedule H – Hazard Areas (Floodplain/Floodway/Riparian Environments)
- Schedule W – Wetlands and Wetland Buffer Areas

QUALIFIED SEWER CONSTRUCTION (ARTICLE 7):

- Schedule B – Sewer Summary
- Schedule C – Sewer Connections
- Schedule E – Lift Station and/or Force Main
  - ➢ Only required for lift stations serving multiple **owners**
- Schedule F – Characteristics of Waste Discharge
  - ➢ In conjunction with Schedule G, for facilities producing **industrial wastes**
- Schedule G – Treatment or Pretreatment Facilities
  - ➢ In conjunction with Schedule F, for facilities producing **industrial wastes**

- Schedule J – Affidavit Relative to Compliance with Article 7
  - Overhead Plumbing and Footing Drain Discharge
  - Only required if **municipality** has not adopted an ordinance requiring overhead plumbing and prohibiting footing drain discharge into the sanitary sewer system (typically unincorporated areas, and rarely required)
- Schedule O – Outfall, Direct Connection, District Owned or Leased Property
  - Required for both new and reconstructed **outfalls**
  - Required for direct connections to **District** Interceptors, **TARP structures**, facilities, or reservoirs
  - Required for **development** on **District** land

MAINTENANCE AND MONITORING PLAN

- Schedule R – Recording and Maintenance
  - Includes Exhibit R – Recording Exhibit
  - To be submitted with permit application, and then final as-built must be recorded and submitted prior to permit close-out (Request for Final Inspection, or RFI)
  - Two notarized copies with original signature required
  - Schedule R/Exhibit R is not required for projects that are not monetized and located in the public ROW or on publicly owned **parcels**.

EARTHWORK PERMIT

An Earthwork/Foundation Limited Permit (Earthwork Permit) may be issued by either the District or an Authorized Municipality. The Earthwork Permit must be signed and sealed by a registered **Professional Engineer** and approved by the **Permittee**, who will guarantee the site will be brought into compliance with the WMO should the project default during construction.

This optional permit type exists to provide construction scheduling flexibility while an applicant is working to obtain a full WMO Permit. Obtaining an Earthwork Permit allows for grading and foundation work in limited circumstances (see below), as long as a WMO Permit is submitted within ninety days. **Erosion and sediment control practices** are required, and onsite floodplain must be designated in the field, per the delineation shown on the approved **erosion** control plan. All work performed under this permit type is considered “at-risk”, and may be modified under the WMO permit.

Mitigation for adverse impacts caused by **stormwater runoff** must be made via an unsewered temporary stormwater storage basin, sized for the proposed **development** area by using the simplified nomograph method for detention basins. The temporary mitigation basin must be dewatered mechanically without the use of sewer connections or permanent pump installations. These measures must be provided for all **sites** utilizing Earthwork Permits, regardless of **ownership interest**.

The Earthwork Permit is <u>prohibited</u> for **sites** with potential impacts to **wetlands** or **riparian environments**.

Only grading or foundation work outside the **flood protection area** is allows under the Earthwork Permit. The following activities are <u>not</u> allowed under this permit type:

- **Qualified sewer construction**
- **Development** in the **regulatory floodplain** or **regulatory floodway**
- **Volume control practices**
- **Detention facilities**
- **Outfalls** to **waterways**
- **District** impacts

SFHA PERMIT

A Single Family Home – Special Flood Hazard Area (SFHA Permit) may be issued by either the **District** or an **Authorized Municipality**. The SFHA Permit ensures proper elevation protection for **single-family home parcels** located within the **regulatory floodplain**. The first section of the SFHA Permit seeks to determine whether the **single-family home** is within a flood zone by elevation. The following sections determine required building elevation and **compensatory storage**.

The SFHA Permit is also applicable to **single-family homes** within 100-feet of the mapped **FEMA FIRM**. The SFHA Permit will be used to make a determination of whether the **single-family home** is within the flood zone by elevation, or is reasonably protected by already being elevated above the **BFE**. If already above the **BFE**, the SFHA Permit will be issued without requiring **building** elevation or **compensatory storage**, as long as no **development** occurs within any of the **parcel** area with elevation below the **BFE**. A **single-family home** located within 100-feet of the mapped **FEMA FIRM** that can demonstrate protection from **flooding** by a berm or other elevated barrier may be considered to be out of the **floodplain** by elevation.

NRI

A Notification and Request for Inspection (NRI) is only applicable for certain types of **qualified sewer construction**, which are found in §701.1 of the WMO, and is solely issued by the **District**. The NRI is not required to be signed and sealed by a registered **Professional Engineer**, and can be submitted by the **owner**, the **municipality**, a contractor, or a design engineer. Engineering plans are not required, and a sketch or marked-up aerial map can serve to indicate where the **qualified sewer construction** is located.

The NRI is primarily used for sewer rehabilitation projects within **municipalities** or sanitary districts. However, minimal new sewer can be permitted under an NRI if all the following conditions are met:

- New sewer is less than 25 linear feet
- New sewer does not include a new building service connection
- New sewer does not make a new service connection to the existing public sewer main
- Replacement sewer is the same size and within 5-feet of the original alignment
- **Development** area is less than 0.50 acre

Demolition of an existing **building** and re-use of the sewer for a replacement or new **building** is considered a new **building** connection, even if the **building** is within the same footprint, and this **qualified sewer construction** requires a WMO Permit.

FCA

A **Facility Connection Authorization** (FCA) may only be used within the City of Chicago and is solely issued by the **District**. The FCA must be signed and sealed by a registered **Professional Engineer** to indicate the technical submittal meets the design criteria contained in the WMO.

Direct connections to **District** facilities and new or reconstructed **outfalls** to a **waterway** or Lake Michigan require an FCA when located within the City of Chicago. Refer to Article 2 of this **TGM** for more information on FCA applicability.

PERMIT REVISION

A Permit Revision may be issued by either the **District** or the **Authorized Municipality** which originally issued the WMO Permit. Permit Revisions document any proposed changes to the approved permit. A Permit Revision may be obtained by submitting the following:

- A letter from the design engineer describing the changes and reason for the changes
- A letter from the municipal/system engineer granting approval of the changes
- Two (2) copies of revised design drawings (only the sheets that have changed), signed and sealed by the design engineer of record
- Two (2) copies of revised permit forms, signed and sealed by the design engineer of record
- Fee Payment Voucher and Permit Revision fee

Permit Revisions can be applied for prior to the approval of the Request for Final Inspection (RFI). In some cases, Permit Revisions related to minor modifications to **District** permitted **detention facilities** can be done after the RFI is approved.

§300 GENERAL REQUIREMENTS

This section of the WMO covers some universal requirements and limitations of **Watershed Management Permits**.

Either the **District** or the relevant **authorized municipality** will make the final determination that all pertinent information has been submitted to either begin review or issue a **Watershed Management Permit**. Additional information, calculations, or documentation may be requested at any time prior to issuing the **Watershed Management Permit**. Specific submittal requirements are addressed later in this Article. Further information on **authorized municipalities** can be found in Article 14 of this **TGM**.

LIMITATIONS

The issuance of a **Watershed Management Permit** does not:

A. Convey any property rights or any exclusive privilege

B. Authorize any injury to private property or invasion of private rights

C. Release the **permittee** or **co-permittee** from liability for damage to **persons** or property resulting from the work covered by the permit.

QUALIFIED PERSON

The presence of **regulatory floodplain** or **regulatory floodway** must be acknowledged or denied by a **Professional Engineer**. While the presence of **regulatory floodplain** and **regulatory floodway** on a project site can be determined by reviewing the effective Flood Insurance Rate Maps (**FIRMs**), effective Flood Insurance Study (**FIS**) profiles, and the site-specific topography, the presence of **wetlands/buffers** and **riparian environments** requires training and experience in identifying these areas. Most **Professional Engineers** have not undergone this type of training, and most likely will not make the statement as it pertains to **wetlands** or **riparian environments**.

When sufficient evidence indicates the possible presence of **wetlands/buffers** and **riparian environments**, the project submittal must include a certification from a **Wetland Specialist** or **Professional Engineer** either denying or acknowledging the presence of these areas. If present, Schedule W must be submitted as part of the **Watershed Management Permit** and prepared by a **Wetland Specialist.** The **Wetland Specialist** is responsible for the review of all delineation reports, impacts, mitigation plans, and other documentation related to **wetlands**, buffers, and **riparian environments**. Sufficient evidence consists of answering “Yes” to any of the questions contained in the *Onsite and Offsite Cursory Wetland Determination Procedure* that is provided later in this Article, under the ***Wetlands** and **Buffers** Submittal Requirements* section.

To qualify as a **Wetland Specialist**, a person must meet the requirements of a), b), c), or d) below:

A. Certified as an Environmental Scientist in DuPage County or a Certified **Wetland Specialist** (CWS) in Lake County;

B. Professional **Wetland** Scientist certification by the Society of **Wetland** Scientists (SWS);

C. Minimum of a bachelor's degree in a biologic science or earth science and at least one of the following:

   1) Three (3) years cumulative (full-time) **wetlands** experience in the Upper Midwest Region on **wetland**-related projects; or

   2) Completion of at least 100 **wetland** delineation projects in the Upper Midwest Region;

D. Six (6) years cumulative (full-time) **wetlands** experience in the Upper Midwest Region on **wetland**-related projects without a degree type noted above.

SOLE PERMITTEE

EXISTING SOLE PERMITTEE

Some issued permits in unincorporated areas allowed **sewage** to discharge directly to a **District** interceptor sewer. These permits were not signed by a **municipality** and are known as **Sole Permittee** permits. If a proposed **development** including **qualified sewer construction** was previously permitted in an unincorporated area and is now within a **municipality's** corporate limits, the new permit will not be considered a **Sole Permittee** permit and must be signed by the **municipality**. Existing **Sole Permittee** permits still located in an unincorporated area are assumed to have a special condition requiring surety (maintenance bond or evidence of financial responsibility) for the sewer systems. When a permit application is submitted for proposed work, the existing surety amount may require update for cost inflation and shall be updated to include the new sewer work. If the existing permit does not include the requirement for surety, it will be required for the proposed work. The surety amount should be set as the nominal construction cost of building the **sanitary sewer** system as submitted by the applicant, plus a cost factor for surface improvements, i.e., sidewalks, driveways, buildings, landscaping, etc. that may have to be replaced in conjunction with repairs, and an annual increase in the amount due to inflation. The surety must be a source of funds from which the **District** can draw upon the default of the **Sole Permittee**. Some existing **Sole Permittee** permits do not require the above mentioned surety because the property **owner** provided an easement to the **District** and in exchange was granted a connection to a **District** interceptor for sole and exclusive use.

NEW SOLE PERMITTEE

The **District's Board of Commissioners** approval is required for all new **Sole Permittee** permits which include **qualified sewer construction**. They are only accepted in unincorporated areas, and if any potential **Permittee** provides written documentation refusing to sign the **Watershed Management Permit**, and the **Co-Permittee** complies with the following:

1) The facilities to be serviced are for the sole and exclusive use of the property **owner**, and no sewer extension is contemplated for other private users
2) The area to be served is outside the jurisdiction of any local sanitary district or public utility company certified for such services
3) Explore the feasibility to connect to sewer system in adjacent jurisdiction(s) and if not allowed, obtain written denial
4) Provide surety as mentioned above in Existing **Sole Permittee** section;
5) Record permit with the Cook County Recorder of Deeds against the title of the property
6) If the sewer systems extend off of the **Sole Permittee's** property, provide easement(s) and/or agreement(s) to demonstrate permission to access areas for construction and subsequent **maintenance**
7) Provide evidence of fee simple **ownership** of the property to be served, and a copy of the legal description of the property. If property **owner** is part of a corporation, submit a license to do business in Illinois. If property **owner** is other than an individual, submit names of officers or partners
8) Attend a pre-meeting with **District** staff to discuss proposed interceptor connection

For projects that include **stormwater** or **development** without a **Permittee**, the **Watershed Management Permit** may be issued without Cook County signing as the **Permittee**, if they refuse to do so in writing**.** The permit must be recorded with Cook County Recorder of Deeds according to §307. Townships that have sewer or **stormwater** authority would be considered the **Permittee**, and those projects would not be subject to **Sole Permittee** provisions.

NON-DISTRICT APPROVALS

FEDERAL AND STATE AGENCIES

Prior to **start of construction**, all appropriate approvals from federal and state agencies must be obtained. Many of these approvals will be part of the various **Watershed Management Permit** submittals, including, but not limited to, **OWR** approval for construction in the **floodway**, **Corps** approval for impacts to **jurisdictional wetlands**, **IEPA** approval for discharge to **waterways**, and **IDOT** approval for roadwork. Additional necessary federal and state approvals must be obtained, even if not required under the **Watershed Management Permit**.

LOCAL AND REGIONAL AGENCIES

Local approval must be obtained from the **municipality** (**permittee**) in order to apply for a **Watershed Management Permit**. Prior to **start of construction**, any required regional approvals must be obtained, even if not required under the **Watershed Management Permit**. Examples of regional authorities include, but are not limited to, townships, conservation districts, drainage districts, highway departments, and park districts.

FOREST PRESERVE DISTRICT OF COOK COUNTY

Applicants proposing **runoff** at a location on or adjacent to holdings or property of Forest Preserve District of Cook County (FPD) shall contact FPD for review of the proposed work to determine **stormwater** impacts to FPD property and methods to reduce or eliminate any adverse impacts.

This requirement applies only to projects proposing the following:

A. Any work directly on FPD holdings or property;

B. Projects located adjacent to FPD holdings or property consisting of any of the following:

1) New point discharges onto FPD holdings or property;
2) Direct **storm sewer** connections to FPD owned infrastructure; or
3) Proposed **runoff** that causes the **hydrology** on FPD holdings or property to fall below eighty percent (80%) or exceed one-hundred fifty percent (150%) of the existing condition **storm event runoff** volume for the 2-year, 24-hour **storm event**.

For projects in any of the above categories, written notification shall be submitted indicating the FPD has been made aware of the proposed project (for instance, a letter carbon copied to the **District** in which documents were transmitted to FPD for review, comments from the FPD on the proposed project, etc.) The FPD shall be contacted at:

Director of Planning and Development
Forest Preserve District of Cook County
536 North Harlem Avenue
River Forest, IL 60305

The WMO does not regulate how FPD makes determinations of adverse impacts, nor does it dictate methods for obtaining approval from FPD. All proposed **development** must meet, or exceed, the requirements of the WMO, regardless of the requirements of the FPD. The requirement to contact the FPD, as outlined in §300.5, does not apply to the following:

- **Development** not adjacent to FPD property;
- Non-adjacent **parcels** that are eventually, but not directly, tributary to FPD infrastructure;
- Direct connections to infrastructure not owned by the FPD; and
- Existing **outfalls** that are not being reconstructed.

PERMIT FEES

Per §301.1, the **District** shall establish a schedule of permit fees, which may be amended from time to time. The current permit fee schedule is found in Appendix F of the WMO, and is approved by the **District's Board of Commissioners**. **Authorized Municipalities** establish their own fee schedules. Certain **District** fees apply for permits issued by an **Authorized Municipality**, which are discussed below.

Fees are due at the time of application, and must be submitted with a Fee Payment Voucher, outlining which fees are being paid. The Fee Payment Voucher is located on the **District's** WMO website, at wmo.mwrd.org. A **Watershed Management Permit** application will not be accepted without at least the Base Permit Review Fee accompanying the submittal. If the permit application is cancelled, some fees may be refundable, as indicated in the following fee descriptions.

Watershed Management Permits will not be issued without obtaining all required fees.

BASE PERMIT REVIEW FEES

A **Watershed Management Permit** application will not be accepted without receiving at least the Base Permit Review Fee. These fees are listed in Section I of Appendix F, and are considered non-refundable once review of the **Watershed Management Permit** application has commenced. Each permit type has a different Base Permit Review Fee associated with it.

Resubmittals associated with a **Watershed Management Permit** currently under review are not charged fees for any additional review(s).

DETENTION REVIEW FEES

Detention Review Fees are listed in Section II of **Appendix F**. These fees are applicable to **developments** or **redevelopments** that meet the detention thresholds listed in Table 2 of Article 5 of the WMO. These projects are required to provide new detention (Schedule D) or demonstrate capacity via **existing detention facilities** (Schedule D-Legacy). Note that Schedule D includes runoff and volume control, and is usually required, regardless of detention requirements. The presence of Schedule D in the **Watershed Management Permit** application does not automatically trigger Detention Review Fees.

Schedule D or Schedule D-Legacy must accompany a WMO Permit and cannot be used under an NRI, FCA, or SFHA Permit. Schedule D is used to document **runoff** mitigation under an Earthwork Permit; however, this is not considered detention, nor the required Schedule D for the **site**.

The Detention Review Fees are dependent on the size of the development and whether the **site** is using the nomograph method or modeling for sizing the restrictor and volume of the **detention**

facility. The specific fee breakdown is found on the Fee Payment Voucher and Appendix F of the WMO. This fee is considered refundable only until review has occurred.

More information on detention design guidelines and whether a **development** qualifies for Schedule D-Legacy instead of Schedule D can be found in Article 5 of this **TGM**.

ISOLATED WETLAND/RIPARIAN ENVIRONMENT REVIEW FEES

Isolated Wetland/Riparian Environment Review Fees are listed in Section III of Appendix F, and are accompanied by Schedule W. If only **riparian environments** are present, and there are no **wetlands**, Schedule H may be used instead. Fees for Schedule H are listed below under *Other Fees*.

Schedule W is required for verification of **isolated wetlands** and mitigation of impacts to **isolated wetlands** and **riparian environments**. Schedule W must accompany a WMO Permit and cannot be used under an Earthwork Permit, NRI, FCA, or SFHA Permit.

The **Isolated Wetland/Riparian Environment** Review Fees are dependent on whether mitigation is required, and also how much mitigation is being proposed. The specific fee breakdown is found on the Fee Payment Voucher and Appendix F of the WMO. This fee is considered refundable only until review has occurred.

More information on **wetland** and **riparian environment** design and mitigation requirements can be found in Article 6 of the WMO and this **TGM**.

QUALIFIED SEWER CONSTRUCTION FEES

The following fees related to **qualified sewer construction** are listed in Section IV of Appendix F, and are applicable as described below.

SEWER INSPECTION FEE

Sewer Inspection Fees are required for all **qualified sewer construction** proposed within the **District's** service area, with the exception of **storm sewers** tributary to **waterways** within the **combined sewer area** and underdrains associated with **volume control practices**. Details on what is considered **qualified sewer construction** are found in Article 7 of the WMO and this **TGM**.

The Sewer Inspection Fee is applicable under the WMO Permit, FCA, and NRI, and should be submitted with the initial permit application.

For underground **detention facilities** tributary to **combined sewers**, Sewer Inspection Fees are charged based on the longest length of the underground vault. The Sewer Inspection Fee applies for all lengths of underground detention storage in pipes. The Sewer Inspection Fee is refundable for any length of sewer not constructed. However, additional fees will be required after construction if field changes necessitate installing more **qualified sewer construction** than originally approved under the **Watershed Management Permit**. In such cases, the **Co-Permittee** will be invoiced for the additional Sewer Inspection Fee.

SCHEDULE E – LIFT STATIONS

Schedule E is required for construction or reconstruction of public lift stations, and must accompany a WMO Permit or FCA. Schedule E cannot be used under an Earthwork Permit, NRI, or SFHA Permit.

The associated review fee is required for any permit with a Schedule E. The fee should be submitted with the initial application. This fee is considered refundable only until review has occurred.

SCHEDULE O – OUTFALLS, DISTRICT IMPACTS

Schedule O is required for new or reconstructed **outfalls**, direct connections to **District** infrastructure, or development on **District** owned land. Schedule O must accompany a WMO Permit or FCA, and cannot be used under an Earthwork Permit, NRI, or SFHA Permit.

The associated review fee is required for any permit with a Schedule O. The fee should be submitted with the initial application. This fee is considered refundable only until review has occurred.

CONNECTION IMPACT FEES

Connection Impact Fees are generally rare and will only apply to areas annexed into the **District's** service area after July 9, 1998. These fees serve to recover historic capital and infrastructure costs. Fees will be assessed at such time as **development** requiring a **Watershed Management Permit** is proposed in these annexed areas. **Connection Impact Fees** are applicable to the **disturbed area** for all permit types. *Note: Parcels that contain publicly owned facilities performing a government function or those considered property tax exempt are not subject to **Connection Impact Fees**.*

The schedule of Connection Impact Fees is as follows:

- First 10% due with the initial permit application submittal
- Next 50% due within one-year of **start of construction**, or substantial completion, whichever occurs first
- Final 40% due with the RFI submittal, or two years after **start of construction**, whichever occurs first

Any areas dedicated as **right-of-way** (ROW) can be considered exempt from **Connection Impact Fees**. If an area is dedicated as ROW after a scheduled payment has been made, that portion of the payment will not be refunded. However, future payments may exempt the newly dedicated ROW area. **Connection Impact Fees** are only refunded if the **Watershed Management Permit** is cancelled or expires.

OTHER FEES

The following fees are listed in Section V of Appendix F and are applicable in some cases, as described below.

SCHEDULE R – RECORDATION DEPOSIT

Schedule R is required for most **developments**, and must accompany a WMO Permit. Schedule R is not applicable under an Earthwork Permit, NRI, FCA, or SFHA Permit.

The Recordation Deposit is required for any WMO Permit with a Schedule R. The fee should be submitted with the initial application. **Applicants** should keep an original copy of the Schedule R for recording purposes. At such time as the **applicant** records the as-built Schedule R/Exhibit R with Cook County and submits a copy to the **District**, the Recordation Deposit will be refunded.

SCHEDULE H – HAZARD AREAS

Schedule H is required for onsite floodplain, floodway, or riparian environments, and must accompany a WMO Permit or FCA. Schedule H cannot be used under an Earthwork Permit, NRI, FCA, or SFHA Permit.

The associated review fee is required for any permit with a Schedule H. The fee should be submitted with the initial application. This fee is considered refundable only until review has occurred.

SCHEDULE L – NOTICE OF REQUIREMENTS OF STORMWATER DETENTION

Schedule L is required for **parcels** meeting the detention threshold with at least 0.50 acre of proposed undeveloped land in which detention is only provided for the proposed **development** area and not for the portion of the of the **parcel** that will remain undeveloped and in its natural/native condition. Schedule L, and the associated Exhibit A, must accompany a WMO Permit, and cannot be used under an Earthwork Permit, NRI, FCA, or SFHA Permit. Note that Exhibit A is also associated with Schedule K, which has no fee requirement. The presence of Exhibit A in the **Watershed Management Permit** does not automatically trigger fees.

The associated review fee is required for any WMO Permit with a Schedule L. The fee should be submitted with the initial application. The **District** will record the Schedule L/Exhibit A with Cook County and invoice the **Co-Permittee** for the recording fee.

VIOLATION INSPECTIONS

If an **applicant** is sent a Notice of Violation (**NOV**), inspections related to the violation will incur fees as listed in Appendix F of the WMO. These fees will be invoiced or made part of the violation settlement. Violation Inspection fees are non-refundable in all cases.

VARIANCE FILING AND REVIEW

The **Variance** process is detailed in Article 11 of the WMO and this **TGM**. The fee is required at the time of filing to offset the processing and review costs. A Petition for **Variance** will not be accepted without submitting the full Filing and Review fee. This fee is considered fully or partially refundable only until the **Director of Engineering's** report is written.

Additional information on **Variances**, including fee refunds, can be found in Article 11 of this **TGM**.

FEES FOR AUTHORIZED MUNICIPALITY PERMITS

Authorized Municipalities set their own review fees. However, certain approvals must be granted by the **District** prior to issuing **Authorized Municipality** Permits, and the associated fees must be collected by the **District**. These fees include only the following, when applicable:

- Sewer Inspection Fee
- Schedule E
- Schedule O
- Connection Impact Fees

All other fees in Appendix F are waived by the **District**. The above fees may be submitted with a Fee Payment Voucher to the **District** before or during permit review. Payment of any other permit review fees are subject to the local rules and regulations of the **Authorized Municipality** and shall be coordinated with the Engineer or **Enforcement Officer** of the **Authorized Municipality**. Further information on **Authorized Municipalities** is found in Article 14 of the WMO and this **TGM**.

SINGLE-FAMILY HOME PERMIT FEES

In general, **development** of **single-family home parcels** do not require fees from the **District**. Fees are never required for SFHA Permits. However, there are two instances in which a WMO Permit is required instead of a SFHA Permit. **Single-family home** projects are not considered fee exempt when the **development** includes:

- **Wetlands** and/or **riparian environments**

- An extension of the public sewer

PUBLICLY FUNDED PROJECTS

Publicly funded projects, such as municipal road projects, public sewer rehabilitation, government buildings, parks, and public schools, may be exempt from fees. However, **developments** on public land or **development** of land that is monetized is not considered a fee exempt project, even when undertaken by a **municipality**.

The **District** administers this policy in the spirit of intergovernmental cooperation, and reserves the right to modify this exemption at any time.

WATERSHED MANAGEMENT PERMIT APPLICATION SUBMITTALS

There are certain submittal requirements that must be met prior to the **District** accepting a **Watershed Management Permit** application. Utilizing the Minimum Submittal Requirements Checklist, which can be found on the **District's** WMO website, at wmo.mwrd.org, is the best way to ensure the application will be received and reviewed without delay. If an incomplete submittal is sent to the **District**, one copy of the submittal is kept on file and all other copies will be returned to the applicant without review.

Specific submittal requirements are detailed in the following sections. Note, that plan sheet and exhibit specifications for each submittal are found in the *Exhibits and Plan Sheets Submittal Requirements* section following the specific submittal sections.

GENERAL SUBMITTAL REQUIREMENTS

The following must be submitted for each **development** requiring a **Watershed Management Permit**:

- Two (2) copies of the applicable **Watershed Management Permit** application with all necessary original signatures
- Two (2) copies of all applicable Schedules, with original signatures, if necessary
- Two (2) copies of the plan set, with original seal and signature for all permit types except NRIs. Additional copies may be requested as part of the final permit approval.
- The common address, legal description, and property index number (PIN) of the **site** where the **development** will take place. This information can be included by submitting a topographic survey, Exhibit A, Exhibit R, or listing on the general plan set.
- A narrative description of the project, including:
    - Type of development
    - Total **site** or **parcel** (**contiguous ownership interest**) size
    - Size of the area under **development**
    - Denial of **flood protection areas** by either a **Professional Engineer** or **Wetland Specialist** if not present within the **development** area, **site** area, or 100-feet from the development if offsite.
- One (1) copy of Fee Payment Voucher Form with applicable fees

- One (1) copy of all applicable calculations, exhibits, and documentation, with original seal and signature by a **Professional Engineer**, as indicated in the specific submittal requirements sections of this Article of the **TGM**.

Submit the above items to:

MWRD Engineering Department
Local Sewer Systems Section
111 East Erie Street, 6th floor
Chicago, IL 60611

If the proposed **development** is within the corporate limits of an **authorized municipality**, then the submittals should be sent to the **municipality's enforcement officer**. If the proposed **development** involves any activities listed in §201.2 of the WMO, the applicable portions of the submittals will be forwarded to the **District** by the **authorized municipality**. Note, NRIs do not fall under the jurisdiction of an **authorized municipality**, and shall always be submitted to the **District**.

PERMIT SIGNATURES

All **Watershed Management Permit** applications must be submitted with original signatures. If the parcel is located within a **municipality's** corporate limits, both the **Co-Permittee(s)** and **Permittee** must sign the **Watershed Management Permit**. The **municipality** is the **Permittee** and the property **owner(s)** is the **Co-Permittee**.

For WMO Permits, the **municipality** or their system engineer must also sign as the *Municipal or System Engineer* on Page 8. Some permit applications require multiple sets of certifications (Pages 8 and 9) when the **sanitary** or **combined sewer** system is not owned by the **municipality**. One set provides certification for the sewer system and the other set provides certification for the **development**. When the receiving sanitary or combined sewer system routes flow through more than one **municipality**, an additional Page 8 and Page 9 are required to document approval by downstream sewer owners.

For **developments** located in unincorporated **Cook County**, the *Certificate by Municipal Engineer* and **Permittee** signatures should be obtained from the **Cook County** Building and Zoning Department. The contact information is:

Building and Zoning
Bureau of Economic Development
69 West Washington, Suite 2830
Chicago, Illinois 60602
Telephone: (312) 603-0500
Fax: (312) 603-9940
TDD: (800) 526-0857
http://www.cookcountyil.gov/building-and-zoning

Cook County does not have authority over **sanitary** or **combined sewer** systems. If the project is located in a Township that does have sewer authority, the Township must sign as the **Permittee**. Otherwise, the project may be subject to the **Sole Permittee** provisions of §300.3.B of the WMO.

The engineering certifications on Page 8 of the WMO Permit application must be signed by a **Professional Engineer**, as defined in the WMO. The design and inspection engineers do not necessarily need to be based in Illinois, but must have a current valid Illinois PE license. The **Professional Engineer's** dated original ink signature and valid Illinois seal must be affixed to the permit application, plans, calculations, and applicable Schedules.

EROSION AND SEDIMENT CONTROL SUBMITTAL REQUIREMENTS

The **erosion and sediment control** regulations are provided in Article 4 of the WMO and this **TGM**. An itemized checklist of submittal requirements is available on the **District's** WMO website, at wmo.mwrd.org.

The **Erosion** and **Sediment** Control Submittal shall include Schedule P, with original signature by the property owner, the **NPDES** ILR-10 permit information, if applicable, and a narrative that can either be a separate report or included with the required general permit submittal narrative. For sites with **disturbed area** greater than 1.0 acre or part of a larger planned common development, or if required by the **IEPA**, the ILR-10 permit number issued by the **IEPA** must be provided on Schedule P. The issued ILR-10 permit must be submitted to the **District** prior to **start of construction**. Note that **sites** tributary to a **combined sewer** do not require the ILR-10 permit.

The **erosion** and **sediment** control plan shall include descriptions of the following:

- Existing land cover
- Geotechnical report, including a soils report and soil boring logs
- Hydrologic conditions of the proposed **development**
- Areas adjacent to the **development** including a description of **flood protection areas**, **site** discharge location(s), **outfalls**, and soil survey data
- Proposed temporary erosion and sediment control practices
- Description of how **flood protection areas** will be protected from **erosion** and **sedimentation** both temporarily and permanently
- Mechanism for ensuring that the **erosion** and **sediment** control installation and **maintenance** requirements for both temporary and permanent measures will be met, including the list of **maintenance** tasks and performance schedules that have been identified and/or required in the plan sheet(s) and specifications

For work directly in Lake Michigan, approval must be obtained from the **Corps**. The Schedule P should reflect that this is a "special area" and approvals from the regulating agencies must be made part of the **Erosion** and **Sediment** Control Submittal.

Data and calculations must be included in the plan, which are used to size, locate, design, and maintain all erosion and sediment control practices and temporary stream crossings. Details on erosion and sediment control plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

STORMWATER MANAGEMENT SUBMITTAL REQUIREMENTS

The **stormwater** management regulations are provided in Article 5 of the WMO and this **TGM**. Because the **stormwater** management requirements of the WMO are complex and specific to the different types of **development**, a flowchart has been provided to help applicants navigate the **stormwater** permitting process. The **site runoff**, **volume control**, and detention requirements are a function of the the size of the **contiguous ownership interest** (**parcel**). Because the WMO provides detention allowances for certain **redevelopments**, the flowchart includes these detention requirements as well. The flowchart and an itemized checklist of submittal requirements is available on the **District's** WMO website, at wmo.mwrd.org.

The **Stormwater** Management Submittal shall include the required Schedule D or Schedule D-Legacy, with original signature by a **Professional Engineer**. Schedule D-Legacy is used for **redevelopment** of **sites** with **detention facilities** permitted under the SPO or **existing detention facilities** constructed prior to the effective day of the WMO (May 1, 2014). All other **sites** will utilize Schedule D for **stormwater** management. The following additional permit forms may also be required:

- Schedule K: If the **contiguous ownership interest** of the **parcel** is less than the detention thresholds listed in Article 5 Table 2 of the WMO, the Affidavit of Disclosure of Property Interest (Schedule K) must be submitted. The Schedule K must have an original signature from the property **owner**, signature and seal of a Notary Public, and exemptions indicated on the form.

- Schedule L: If a **parcel** that meets the detention thresholds of Article 5 Table 2 includes any undeveloped vacant land that is not part of the proposed **development** and is not being included in the detention calculations of the **Watershed Management Permit**, eight copies of the Notice of Requirements for Stormwater Detention (Schedule L) and the Exhibit A must be submitted. Two copies of the Schedule L must have original signatures from the **owner**, partnership, LLC, corporation, or land trust, signature and seal of a Notary Public, and the appropriate paragraphs crossed out, per the note at the bottom of Page 1 of the form.

The **Stormwater** Management Submittal shall also include a narrative, which can either be a separate report or included with the required general permit submittal narrative. The narrative requirements for the **site runoff**, volume control, and detention aspects of **stormwater** management are included in each sub-section below. Details on **stormwater** management plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

SITE RUNOFF

The **site runoff** narrative of the **Stormwater** Management Submittal shall describe all appropriate measures necessary to meet the requirements of §502 of the WMO, and shall include the following information:

- A description of the proposed **development** that includes the area of existing and proposed **impervious areas**
- A description of the existing drainage pattern, including the portion of the parcel that is located in separate **watersheds** defined in the **District's DWPs**, a **separate sewer area**, or a **combined sewer area**, and the discharge point(s) to a **storm sewer**, **waterway** or **combined sewer**.
- A description of the upstream **tributary area** and **stormwater** discharge downstream to allow for evaluation of offsite impacts resulting from the proposed **development**
- A description of soil types, vegetation, and land cover conditions affecting **runoff** of the **development site** for any area draining through or to the **site**

Calculations must also be included as part of the site runoff portion of the **Stormwater** Management Submittal. The calculations must be comprised of **site runoff** and upstream tributary **runoff** calculations, and any other calculations necessary to demonstrate compliance with the WMO. These may include the following, as applicable:

- Documentation identifying the procedures, assumptions, and data used to calculate hydrologic and hydraulic conditions for sizing both **major and minor stormwater systems**
- Time-of-concentration calculations
- Curve number and/or **runoff** coefficient calculations for the existing and proposed conditions
- Calculations for sizing for **major** and **minor stormwater systems**, overland flow routes, and other **stormwater facilities**
- Hydraulic grade line and water surface elevations under design flow, **base flood**, and other tailwater conditions
- Assumptions or calculations utilized to determine tailwater conditions for the **site**

NOTE: If the **development** does not require volume control or **stormwater** detention, and it can be demonstrated that the **development** does not modify drainage patterns upstream or downstream, then the runoff review can be determined by inspection and engineering judgement, and calculations are not necessarily required.

VOLUME CONTROL

The volume control narrative of the **Stormwater** Management Submittal shall describe all appropriate measures necessary to meet the requirements of §503 of the WMO, and shall include the following information:

- A geotechnical report that includes a description of soils, infiltration rates, clay percentage, and depth to the seasonably high **groundwater** level, bedrock, or other limiting subsurface layer
- A description of the utilization of the **volume control practices** hierarchy in §503.3.A-C of the WMO, including use of **retention-based practices, offsite volume control practices,** and **flow-through practices** in §503.3.A and §503.3.B, and for other compliance methods described in §503.3.C
- A description and documentation of any **site constraints** that may preclude the use of **volume control practices**
- Documentation that **flow-through practice(s)** required in §503.3 of the WMO meet the pretreatment requirement

Calculations must also be included as part of the volume control portion of the **Stormwater** Management Submittal. The calculations shall include the following, as applicable:

- The **impervious area** and associated **volume control storage** required for the **development**
- The quantifiable storage provided in each proposed **volume control practice** in §503.3 of the WMO to verify adequate storage;
- Calculation of volumes for other compliance methods described in §503.3 of the WMO, if applicable

DETENTION FACILITY

The **detention facility** portion of the **Stormwater** Management Submittal shall describe all appropriate measures necessary to meet the requirements of §504 or §505 of the WMO, and shall include the following information and calculations, when applicable:

- Documentation identifying the procedures, assumptions, and data used to calculate hydrologic and hydraulic conditions and to determine the post-**development allowable release rate** and required detention volume;
- Determination of **outlet control structure** sizing and storage volume

- Elevation-storage-discharge relationship and associated calculations for the **detention facility** and **outlet control structure**
- Demonstration that the overflow **structure** and overflow path are sized in accordance with §504.11.C of the WMO
- Assumptions or calculations utilized to determine the **BFE** and/or other tailwater conditions for the **site**
- Drawdown time for each **detention facility**

FLOODPLAIN SUBMITTAL REQUIREMENTS

The **floodplain** requirements for **developments** are contained in Article 6, specifically §601 and §602, of the WMO and this **TGM**. Because **floodplain** and **floodway** permitting is complicated and may require approvals from local, state, and federal agencies, a flowchart has been provided to help applicants navigate the **floodplain** permitting process. The flowchart and an itemized checklist of submittal requirements is available at the **District's** WMO website, at wmo.mwrd.org.

The **Floodplain** Submittal shall include Schedule H with original signature by a **Professional Engineer**, correspondence from the **OWR**, and a narrative, as described below. Either a letter of no objection stating that no permit is necessary, or a copy of the completed joint application form (NCR Form 426 "Protecting Illinois Waters"), signed by the **applicant**, must be made part of the **Floodplain** Submittal. Any associated correspondence submitted to or received from **OWR** must also be made part of the **Floodplain** Submittal prior to issuing the **Watershed Management Permit**.

The **floodplain** narrative can either be a separate report or included with the required general permit submittal narrative. The narrative shall include a description of the proposed **development** within the limits of the regulatory floodplain and regulatory floodway, as well as details of **floodproofing** measures, including material specifications, construction methods, and calculations. A determination of the **BFE** and **FPE** and the source of the determination should be described in the narrative, and the **BFE** and **FPE** must be shown on the plan set.

The **Floodplain** Submittal must also include a copy of the effective **FIS Flood** Profile and **FIS Floodway** Data Table for **Cook County**, when available. If the project area is unmapped and there is no published **FIS Flood** Profile or **Floodway** Data Table available, the **District** should be consulted to determine if additional information is available or if a project-specific **floodplain** study is required. Additional information on study requirements is found in Article 6 of the WMO and this **TGM**.

Revisions to the **FIRM(s)** must be submitted to show the most recent **floodplain** and **floodway** data for the **parcel**. Hydrologic and hydraulic calculations, modeling, and all **CLOMR/LOMR** applications must also be included, as applicable.

Calculations are required for **floodplain** fill, **compensatory storage**, and **development** within the **regulatory floodway**, and shall include:

- Cross section profiles of the **floodplain** fill and **compensatory storage**
- A plan view delineating the location of cross sections
- Tabular summary showing fill below and above the existing 10-year **flood** elevation and cuts below and above the proposed 10-year **flood** elevation, up to the **BFE**

For **development in the regulatory floodway**, the following calculations or analyses shall be submitted to demonstrate compliance with §602.25 of the WMO

- Existing and proposed hydrologic and hydraulic analysis (land use and stream systems)
- Tabular summary of existing and proposed flows, **flood** elevations, and **floodway** velocities for the 2-year, 10-year, and 100-year **storm event**
- Input and output for hydraulic and hydrologic computer models
- **Flood** damage analyses for new, modified, or replacement bridges, culverts or impoundments
- Hydraulic analyses of new, modified, or replacement bridges, culverts, or impoundments
- Transition sections as required in §602.28 of the WMO
- Analyses of hydrologically and **hydraulically equivalent compensatory storage**

Details on **floodplain** and **floodway** plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

WETLANDS AND BUFFERS SUBMITTAL REQUIREMENTS

The **wetland** requirements for **developments** are contained in Article 6, specifically §603, §604, and §605, of the WMO and this **TGM**. Because there is some overlap when permitting **wetland/buffers** and **riparian environments**, the submittal requirements are combined into one comprehensive flowchart and submittal checklist, which are available on the **District's** WMO website, at wmo.mwrd.org.

To assist applicants in determining the likelihood of the presence of **wetlands**, the following procedure has been developed. The procedure provides sources and other information that indicate the probability of the presence of **wetlands**.

Wetlands must be delineated and classified by a **Wetland Specialist**. Determination should be made using the *Corps of Engineers Wetland Delineation Manual*, published in January 1987 (https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/4532/).

Supplemental manuals must accompany this guidance, and include the following:

- The most recent version of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Edition*. As of the date of this Article of the **TGM**, Version 2.0, published in 2010, can be found at:

  https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7630

- The most recent version of the *Field Indicators of Hydric Soils in the United States* published by USDA and **NRCS**, in cooperation with the National Technical Committee for Hydric Soils. As of the date of this Article of the **TGM**, Version 8.1, published in 2017, can be found at:

  https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf

A **site** visit should be conducted to determine if there is **wetland** potential.

WETLAND SUBMITTAL REQUIREMENTS

The **Wetland** Submittal is required any time there is an onsite **wetland** or impacts to an offsite **wetland**, regardless of whether the **wetland** is considered isolated or under jurisdiction of the **Corps**. The **Wetland** Submittal shall include Schedule W with original signature by a **Wetland Specialist**. The first part of Schedule W uses a series of questions to identify if additional submittal items are required. Additional submittal items include correspondence from the **Corps**, a **wetland** narrative, a delineation report, and mitigation documentation. If the answer to all the questions in the first part of Schedule W is "no", then the **Wetland Specialist's** original signature serves as a statement of no impact to **wetlands**, and the remaining submittal requirements are not necessary.

The requirements vary slightly between **standard isolated wetlands** and **high-quality isolated wetlands**, which will be discussed below. Projects with **jurisdictional wetlands** do not need to submit the same level of detail required for **isolated wetlands**, but must still submit the correspondence from the **Corps**.

Details on **wetland** delineation and mitigation plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

CORRESPONDENCE FROM THE CORPS

The WMO protects **wetlands** in **Cook County**. However, the WMO only regulates **isolated wetlands**. **Jurisdictional wetlands** must follow the requirements of the **Corps**. Because of this, the jurisdiction must be determined for any **wetlands** located on the **parcel** or offsite **wetlands** with potential impacts. The WMO requires one of the two following items from the **Corps**:

- A jurisdictional determination (JD) from the **Corps** indicating that the impacted **wetland** is not under the jurisdiction of the **Corps**; or
- If required by the **Corps**, a Section 404 permit application, all associated correspondence, and a copy of the completed joint application form (NCR Form 426, "Protecting Illinois Waters") signed by the **co-permittee**.

The JD or the Section 404 and NCR Form 426 applications must be submitted with the WMO Permit to initiate review by the **District**. The approved Section 404 permit, if required, must be submitted prior to issuance of the WMO Permit. A **Corps** Letter of No Objection (LONO) is not an acceptable substitute for either of the above.

WETLAND NARRATIVE

The **wetland** narrative can either be part of a separate report or included with the required general permit submittal narrative. The narrative shall include:

- A description of the **wetland** location with respect to the **development** area
- The size of all **wetlands** and **wetland buffers** on the **site**
- **Wetland** functions, as indicated in §603.1 of the WMO
- Whether **wetlands** are considered **jurisdictional wetlands** or **isolated wetlands**
- Type of **isolated wetland** (high-quality or standard)

ISOLATED WETLAND DELINEATION REPORT

The WMO has different requirements for **standard isolated wetlands** less than 0.10 acre in aggregate, including any isolated waters contiguous to the wetland, as compared to **high-quality**

isolated wetlands and **standard isolated wetlands** greater than or equal to 0.10 acre. These requirements are found in Article 6 of the WMO and this **TGM**.

The following items must always be included in the **Wetland** Submittal:

- A delineation of the **isolated wetlands** consistent with the requirements for **wetland** delineation provided in §603 of the WMO
- All **Corps** "Routine Wetland Determination Data Form(s)"
- Map submittals in accordance with §303 of the WMO

If **high-quality isolated wetlands** and/or **standard isolated wetlands** greater than 0.10 acre are present, the **Wetland** Submittal must also include the following additional information:

- A classification of each onsite **isolated wetland** as either a **high quality isolated wetland** or a **standard isolated wetland**, including a narrative detailing the results of the assessment of specific functions and values. Classification is determined by the following:
- An assessment to determine the Swink and Wilhelm Floristic Quality Index (FQI) and mean coefficient of conservatism (ĉ), carried out within the growing season for all wetlands on the site
    - An Illinois Department of Natural Resources (IDNR) threatened and endangered species consultation
    - A United States Fish and Wildlife Service (USFWS) threatened and endangered species consultation
- Photos of all **wetlands** and **wetland buffers** on the **site**

WETLAND MITIGATION DOCUMENTATION

Impacts to wetlands generally require mitigation measures, as outlined in Article 6 of the WMO and this **TGM**. If mitigation is required, a **wetland mitigation** document must be developed in accordance with §604 of the WMO. Documentation shall be provided, as indicated below, based on the **wetland** classification.

STANDARD ISOLATED WETLANDS

Development that impacts **standard isolated wetlands** with a total acreage less than one-tenth of an acre (0.10 acre), including **contiguous isolated waters** less than one-tenth of an acre (0.10 acre), does not require documentation showing that no practicable alternatives to **wetland** modification exist.

For impacts to **standard isolated wetlands** with a total acreage greater than or equal to one-tenth of an acre (0.10 acre), including **contiguous Isolated Waters**, the **Wetland** Submittal shall include documentation indicating that no practicable alternative to **wetland** modification exists.

The following documentation shall also be provided, if applicable:

- An evaluation of the indirect impacts to **isolated wetlands** on the **site** and **wetlands** 100-feet beyond the area of the **development** if not included within the **site**. Evaluation must include proposed **wetland hydrology** and an inundation and duration analysis.

- For impacts to **isolated wetland buffers**, documentation must be provided that describes how the impacted buffer functions and how its values will be mitigated. **Isolated wetland buffer** impacts may be mitigated via replacement or enhancement of impacted functions and values, or through buffer averaging

- If mitigation is to be provided via a **wetland mitigation bank**, a statement of obligation from the **wetland mitigation bank** showing mitigation acreage reserved for the project

HIGH QUALITY ISOLATED WETLANDS

Impacts to **high quality isolated wetlands** should be avoided whenever possible, regardless of economic impacts. Mitigation measures, as detailed in Article 6 of the WMO and this **TGM**, are more intensive than for **standard isolated wetlands**. For impacts to **high quality isolated wetlands**, documentation must be provided indicating that the proposed impact represents the least amount of impact required to allow for a feasible use of the **parcel**, including:

- The presence of **high quality isolated wetlands** precludes all economically feasible uses of the **site** and no practicable alternative to **wetland** modification exists, and/or

- Avoidance of **high quality isolated wetlands** would create a hazardous road condition and no practicable alternative to **wetland** modification exists

RIPARIAN ENVIRONMENT SUBMITTAL REQUIREMENTS

The **riparian environment** requirements for **developments** are contained in Article 6, specifically §606 and §607, of the WMO and this **TGM**. Requirements found in these sections not only includes impacts to riparian environments, but also impacts to **Jurisdictional Waters of the U.S**.

Because there is some overlap when permitting **wetland/buffers** and **riparian environments**, the submittal requirements are combined into one comprehensive flowchart and submittal checklist, which are available on the **District's** WMO website, at wmo.mwrd.org.

Details on **riparian environment** plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

RIPARIAN ENVIRONMENTS

The **Riparian Environment** Submittal shall include Schedule H or Schedule W with original signature by a **Professional Engineer** (Schedule H) or **Wetland Specialist** (Schedule W). The District will accept either Schedule H or Schedule W, depending on the characteristics of the **site** with regards to other **flood protection areas**, and an inventory of the function of the **riparian environment** in accordance with §606.1 of the WMO. For example, if the **riparian environment** is associated with or located in a **floodplain** or **floodway** and there are no **wetlands**, Schedule H may be submitted. However, if **wetlands** are present, but there is no **floodplain**, the **riparian environment** information may be submitted via Schedule W instead.

A delineation of **riparian environments** shall be made in accordance with §606.2 of the WMO. This section of the WMO indicates how to determine the buffer limits, which dictates the area that is to be evaluated for the presence of **riparian environments**. The boundary of any **riparian environments** located within the buffer limits must be indicated and made part of this submittal and the associated plan sheets.

RIPARIAN ENVIRONMENT MITIGATION DOCUMENTATION

For impacts to **riparian environments**, documentation must be provided that describes the impacted riparian functions and how their values will be mitigated. A mitigation document must be developed in accordance with §607 and plan sheets in accordance with §303.3.K of the WMO. Documentation should include the following:

- The **erosion and sediment control practices** to be utilized to minimize and control **sediment** and degradation of downstream water quality

- The appropriate hydrologic and hydraulic methods analyzing the impacts on **flood** flows and **flood** elevations (to be provided in the **floodplain** and **floodway** submittal) meeting all other requirements in the WMO, including the **floodplain**/**floodway** requirements outlined in §601 and §602 of the WMO

- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details

Impacts to **riparian environments** impacts may be mitigated via replacement or enhancement of impacted functions. Buffer averaging is another mitigation method that may be utilized for **riparian environment** impacts. Article 6 of this **TGM** includes information on mitigation methods and how to meet WMO requirements.

IMPACTS TO JURISDICTIONAL WATERS OF THE U.S.

Impacts to **Jurisdictional Waters of the U.S.** require approval from the **Corps**. If impacts are proposed, one of the following forms of correspondence from the **Corps** must be included in the **Riparian Environment** Submittal:

- A Letter of No Objection (LONO) stating that no permit is necessary
- A Section 404 permit application from the **Corps**, all associated correspondence, and a copy of the completed joint application form (NCR Form 426, "Protecting Illinois Waters") signed by the **applicant**

The signed Section 404 and NCR Form 426 applications submitted with the **Watershed Management Permit** is sufficient to initiate review by the District. However, the approved Section 404 permit must be submitted prior to issuance of the WMO Permit.

Channel relocation of an existing **waterway** shall be mitigated and documented to show that:

- The length of the mitigated channel is greater than or equal to the length of the disturbed channel.
- The proposed methods which will allow naturalizing to occur, such as meandering, pools, or riffles for relocated channels. Proposed methods are expected to be able to withstand all storm events up to the **base flood** without increased **erosion**
- The methods by which the normal flow within the channel will be diverted to construct the new or relocated channel

QUALIFIED SEWER CONSTRUCTION SUBMITTAL REQUIREMENTS

The **qualified sewer construction** requirements for **developments** are contained in Article 7 of the WMO and this **TGM**. Standard details and general notes regarding **qualified sewer construction** are found in Appendix C of this **TGM**. An itemized checklist of submittal requirements is available at the **District's** WMO website, at wmo.mwrd.org. Schedules A, B, and C are always required and made a part of the WMO Permit, even when **qualified sewer construction** is not proposed. The NRI is only used for **qualified sewer construction**, and the FCA is only for **qualified sewer construction** and projects on **District** owned land within the City of Chicago. **Qualified sewer construction** is not allowed under SFH and Earthwork permits.

GENERAL REQUIREMENTS

Most projects will not be subject to all the requirements for **qualified sewer construction**, but some requirements are necessary regardless of project scope. The following items shall be made part of the **Qualified Sewer Construction** Submittal:

- A narrative description of any live sewer connection or live sewer bypass protocol. The narrative can either be a separate report, included with the required general permit submittal narrative, or indicated on the utility plan sheet.

- A recorded **maintenance** agreement between all owners when a new connection to a privately-owned sewer is proposed

- All **District** required general notes, approved materials, applicable standard details (or equivalent), technical requirements, and design guidelines for **qualified sewer construction** available from this **TGM**

Calculations must also be included as part of the **Qualified Sewer Construction** Submittal. The calculations shall be accompanied by a service area and future service area exhibit, and shall include the following, as applicable:

- Population Equivalency (PE) calculations for expected sewer flows based on new, existing, and/or expanded **development**

- Other calculations necessary to demonstrate compliance with the WMO

Sewer lengths and proposed appurtenances shall be listed on the appropriate **Watershed Management Permit** form – NRI, FCA, or Schedule B. All proposed new, rehabilitated, or replaced qualified sewers must be listed on the form. **Non-qualified sewer construction**, such as **storm sewers** in the **separate sewer area** that are tributary to a **waterway** should not be listed on the form. Specifics on what constitutes **qualified sewer construction** is found in Article 7 of the WMO and this **TGM**.

Details on **qualified sewer construction** and utility plan sheet requirements are found in the *Plan Set and Exhibits Submittal Requirements* section following the specific submittal sections.

PUBLIC LIFT STATIONS AND FORCE MAINS

Projects that involve public lift stations and/or force mains must submit Schedule E with the **Watershed Management Permit** application. Public lift stations and force mains are considered to be those that provide service for multiple users, regardless of **ownership**. Private lift stations serving a single **parcel** service sewer are not considered public lift stations and do not require Schedule E.

New construction and replacement/rehabilitation of lift stations and force mains are covered under Schedule E. As stated earlier in this Article of the **TGM**, Schedule E cannot be used under an NRI, and projects proposing this type of work must obtain a WMO Permit.

Calculations for lift station design must be submitted, including:

- Design population including average and peak flow with service area map
- Narrative for basis of lift station design population (service area or actual flow monitoring data)
- Forcemain pipe friction and design head losses
- Wet well capacity, cycle time, detention time
- Narrative of alternative power source
- System curve and pump performance curve
- The logic of the Programmable Logic Controller, including pump operation elevations
- Buoyancy calculations when high **groundwater** is present

INDUSTRIAL WASTES

The **District** allows domestic **sewage** to be discharged into sewer systems tributary to **District** facilities. Any industrial wastes must be evaluated for potential contaminants and prohibited compounds prior to discharge. Pre-treatment of industrial wastes may be necessary to ensure the discharge meets the requirements of the **District's Sewage and Waste Control Ordinance** and User Charge Ordinance. Both ordinances are available on the **District's** website, at mwrd.org.

Any proposed industrial activity must be documented with the permit application by submitting Schedules F and G and a narrative characterizing the wastes being generated, treatment processes, and flow loading. The narrative can either be a separate report or included with the required general permit submittal narrative.

DIRECT CONNECTIONS TO DISTRICT INFRASTRUCTURE

New direct connections to **District** owned infrastructure are discouraged. If there is no viable alternative to making a new direct connection, coordination must be made with the **District's** Local Sewer Systems Section and Collection Facilities/TARP Section. Pre-application meetings are available for **applicants**, with the request that the **municipality** be involved.

District owned infrastructure includes any of the following:

- Interceptors
- TARP Structures
- Reservoirs
- Pump Stations
- Treatment Plants
- District owned land

The **Qualified Sewer Construction** Submittal shall include Schedule O and a narrative of excavation protocol in proximity to **District structures**. **District** owned infrastructure and **structures** must be clearly labeled on the plans. The following items shall also be made part of the submittal:

- **District** direct connection detail available from this **TGM**
- Sewer construction notes associated with construction in proximity of **District** facilities available from this **TGM**
- Clearance distances for all proposed excavation within 15 feet of **District** sewers and **structures**
- Calculations detailing supporting/protection methods for any deep excavation in proximity to **District** infrastructure, certified by a structural engineer

The local **municipality** or applicable utility company is required to own and maintain the length of sewer from the proposed connection point to the drop manhole directly upstream of the connection. If there is no local sewer owner in an unincorporated area, the connection would be considered a **Sole Permittee** and would be subject to the requirements for **Sole Permittees** found in §300.3.B of the WMO and this Article of the **TGM**.

Schedule O is also required for any **development** proposed on **District** owned land. Coordination for easements may be required from the **District's** Law Department. **Applicants** should consult their lease agreement prior to submitting a **Watershed Management Permit** application.

OUTFALLS

The WMO requires a **Watershed Management Permit** for new and reconstructed **outfalls**. Reconstruction of an **outfall** may include, but not be limited to, any of the following:

- Constructing a new headwall
- Moving or extending the **outfall** pipe
- Changing the size of the **outfall**
- In-kind replacement

Maintenance of an **outfall** is limited to grouting, patching, or other cosmetic modifications that do not change the **outfall structure**. Usually, if an **outfall** is involved in a project, it is considered **qualified sewer construction** and requires a **Watershed Management Permit**.

The **Qualified Sewer Construction** Submittal for **outfalls** shall include Schedule O and the **outfall** location must be clearly labeled on the plans. The following items shall also be made part of the submittal:

- **District outfall** general notes available from this **TGM**
- Construction details for the proposed **outfall** and energy dissipation
- Construction details of the proposed water quality device, if required

Water quality devices are required for all **outfalls** to Lake Michigan. If an **NPDES** Permit is required by the **IEPA**, it must be submitted prior to obtaining the RFI for the **Watershed Management Permit**. Additional requirements for **outfalls** is found in Article 7 of the WMO and this **TGM**.

MAINTENANCE AND MONITORING PLAN SUBMITTAL REQUIREMENTS

The **maintenance** and monitoring plan submittal requirements ensure that the **applicant** provides a schedule and plan of appropriate **maintenance** for the **development** both during construction and post-construction. The requirements for **maintenance** and monitoring apply to **erosion and sediment control practices**, **stormwater facilities**, **compensatory storage**, **wetlands** and/or **riparian environments**, and **qualified sewer construction**.

The various **maintenance** and monitoring regulations are provided in Article 4, Article 5, Article 6, Article 7, and Article 9 of the WMO and this **TGM**. An itemized checklist of submittal requirements is available at the **District's** WMO website, at wmo.mwrd.org.

The following sub-sections provide guidance on requirements for the **maintenance** and monitoring plan. Details on content requirements for the required Exhibit R are found in the *Plan Set and Exhibits Submittal Requirements* section following this section.

RECORDING SUBMITTAL

The Recording Submittal consists of two copies the required Schedule R, both with original signature by the **Co-Permittee**, signature and seal of a Notary Public, and Exhibit R with **maintenance** plan printed on or attached to the Exhibit R. **Maintenance** agreements required for **offsite volume control practices**, **detention facilities**, and private sewer connections must also be made a part of this submittal. **Applicants** should keep an additional originally signed copy of Schedule R for recording purposes.

Publicly financed projects are not required to record the Schedule R/Exhibit R, but must still provide the **maintenance** exhibit as part of the **Watershed Management Permit** submittal.

STORMWATER MANAGEMENT FACILITIES

The **Maintenance** and Monitoring Plan Submittal includes a scheduled perpetual maintenance program for stormwater management facilities. The stormwater management facilities, as indicated in the WMO, include:

- **Major Stormwater Systems**
- **Volume Control Practices**
- **Stormwater Detention Facilities**
- **Native Planting Conservation Areas**
- Other **Stormwater Facilities**

The following documentation must be submitted:

- Planned **maintenance** tasks and frequency of each task such as removal of **sediment**, debris, mowing and pruning of vegetation, and restoration of eroded areas
- Identification of the responsible parties for performing the **maintenance** tasks
- A description of applicable permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity

COMPENSATORY STORAGE

The **Maintenance** and Monitoring Plan Submittal includes a scheduled perpetual maintenance program for **compensatory storage**. The following documentation must be submitted:

- Planned **maintenance** tasks and frequency of each task such as removal of **sediment**, debris, mowing and pruning of vegetation, and restoration of eroded areas
- Identification of the responsible parties for performing the **maintenance** tasks
- A description of applicable permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity

WETLANDS

The **Maintenance** and Monitoring Plan Submittal includes a scheduled perpetual maintenance program for **wetlands**. The following documentation must be included:

- Proposed soils and soil management activities
- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details
- Proposed **maintenance** and monitoring plan with **maintenance activities** and performance criteria outlined
- Schedule of earthwork, planting, monitoring, and **maintenance**
- A plan for the continued management, operation, and **maintenance** of the **wetland mitigation** measures including the designation of funding sources and the **person** responsible for long-term operation and **maintenance**
- A description of applicable permanent access and **maintenance** and conservation easements granted or dedicated to and accepted by a governmental entity

RIPARIAN ENVIRONMENTS

The **Maintenance** and Monitoring Plan Submittal includes a scheduled perpetual maintenance program for **riparian environments**. The following documentation must be included:

- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details
- Proposed **maintenance** and monitoring plan with **maintenance activities** and performance criteria outlined
- Scheduling of earthwork, planting, **maintenance,** and monitoring
- A plan for the continued management, operation, and **maintenance** of the **riparian environment mitigation** measures, including the designation of funding sources and the **person** responsible for long-term operation and **maintenance**
- A description of applicable permanent access and **maintenance** and conservation easements granted or dedicated to, and accepted by, a governmental entity

QUALIFIED SEWER CONSTRUCTION

The **Maintenance** and Monitoring Plan Submittal includes a scheduled perpetual maintenance program for **qualified sewer construction**. Projects involving solely **qualified sewer construction** do not need the Exhibit R portion of the **Maintenance** and Monitoring Plan Submittal. However, when required for one of the above reasons, the **qualified sewer construction** shall be made part of the Exhibit R. The following documentation must be included:

- Planned **maintenance** tasks and frequency of each task for the removal of objectionable wastes, fats, oils and grease, or any **other wastes** collected in private pre-treatment or separator **structures**
- Planned routine **maintenance** for all private lift station and pumping facilities
- **Maintenance** agreements for all private sewers providing service to multiple **owners**
- Identification of the responsible parties for performing the **maintenance** tasks
- A description of applicable permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity

PLAN SET AND EXHIBITS SUBMITTAL REQUIREMENTS

Plan set and exhibit requirements are provided in §303 of the WMO. It should be noted that not all exhibits and plan sheets will be applicable for a **development**. By using the permitting flowcharts, submittal checklists, and schedules, the applicant can determine which submittal requirements apply to a specific project. Flow charts and checklists can be found on the **District's** WMO website at wmo.mwrd.org.

Depending on the complexity of the proposed **development**, combining plan sheets is desirable if information provided on all plan sheets is clear, specific, and legible. All plan sheets and exhibits shall be no larger than 24" x 36" and contain the following items:

- North arrow
- Legend
- Scale of at least one inch to 10 feet and no more than one inch to 100 feet (e.g., one inch to 50 feet)
- Property and/or **parcel** lines
- Title block with project name and location, sheet name and number, original preparation date, revision date(s), and contact information and address of the design engineer

MAPPING REQUIREMENTS

Some submittal packages either require or are better served by showing a map (aerial, topographic, etc.) The following mapping resources may be used to meet individual submittal requirements:

- United States Geological Survey (USGS) topographic map
- Natural Resources Conservation Service (**NRCS**) soils map noting hydric soils
- **Cook County FIRM**
- National Wetland Inventory (**NWI**)
- Aerial photo of the **site**
- Aerial photo showing onsite **wetland** and offsite **wetland** boundaries and locations of delineation data points
- Historical aerial photographs, USGS hydrological atlas, or other applicable historic information

- All required topographic information must be tied to the North American Vertical Datum of 1988 (NAVD88).

PLAN COVER SHEET

The plan cover sheet shall indicate all relevant information to navigate through the plan set. The location map, as described below, shall be included, as well as an index of sheets found in the plan set.

The location map must be included for every **Watershed Management Permit** submitted, and shall identify the project **site**, street names, highways, railroads, and **waterways**. The location map shall be to scale and include a delineation of one or both of the following, as applicable:

1) The conveyance route and indication of **ownership** of the storm drainage from the **development** to the receiving **waterway**
2) The conveyance route and indication of **ownership** of the **sanitary**, **storm**, and/or **combined sewers** from the **development** through the local sewer system(s) to the receiving **District** interceptor or facility

The above routing information must be provided on the cover or title sheet unless reference is provided on the cover or title sheet indicating routing is shown on a subsequent plan sheet. The plan cover sheet must contain the name and location of the project and original seal and signature of the **Professional Engineer** of record, who must be licensed in the State of Illinois.

MWRD GENERAL NOTES PLAN SHEET

The MWRD General Notes are provided on a standard plan sheet that can be found in Appendix C of this **TGM**, and also on the **District's** WMO website at wmo.mwrd.org. The MWRD General Notes are available in both PDF and .dwg formats.

EXISTING CONDITIONS PLAN SHEET

The existing conditions plan must show an accurate depiction of the **site** as it exists prior to any proposed development. The plan sheet shall contain the following:

- Benchmark location and information
- A delineation of any permitted **stormwater management facilities** and **structures**
- A delineation of any pre-development **flood protection areas** on the **site**
- Existing contours on entire **site** and 50 feet beyond the **site**, at a minimum of one foot intervals

- All existing **structure** elevations and contours if the **structure** is within 100 feet of the **development** area, including top of foundation, **lowest floor**, **lowest entry elevation**, and **floodproofing** elevations
- Existing **structures**, parking lots, driveways, sidewalks, pathways, trails, and other **impervious areas** on the **site**
- All existing **stormwater facilities** including pipes, field tile, culverts, and inlets on entire **site** and 50 feet beyond the **site**. Information regarding the invert and rim elevations, pipe sizes, pipe lengths, and material type shall be provided
- Existing utilities including sanitary, storm, water main, or any other utilities that exist on the **site**. Information regarding the invert and rim elevations, pipe sizes, pipe lengths, and material type must be provided
- **District** infrastructures, when located on the **site**
- Existing trees and vegetation areas on the **site**

DEMOLITION PLAN SHEET

The **demolition** plan sheet shall show all **demolition** proposed for the **site**. This plan may be combined with the existing conditions plan, as long as the information on the plan sheet is legible.

DIMENSIONAL OR SITE GEOMETRY PLAN SHEET

The dimensional or site geometry plan sheet shall show all proposed development for the site. Proposed work must be clearly marked and differentiated from existing or undisturbed areas. If legible, this may be shown as an overlay to the existing conditions plan or combined with the development area exhibit discussed later in this section of the TGM.

PAVING PLAN SHEET

The paving plan sheet serves to indicate the materials used for paving, such as asphalt, concrete, permeable pavers, and gravel. This is used as a confirmation of development and maintenance areas. If legible, this plan may be combined with the grading plan, development area exhibit, or other related plan sheet.

GRADING PLAN SHEET

The grading plan sheet shall include a topographic layout of the site and shall contain the following:

- Benchmark location and information

- Delineated limits of any **flood protection areas** on the **site**
- Delineation of stormwater management facilities and HWL
- Proposed contours of the **development** area.
- Existing contours within 50 feet of proposed contours, including offsite
- Both existing and proposed contours shall be shown on the same plan when legible
- Proposed spot elevations demonstrating drainage patterns, including curb and gutter
- Location of storm, sanitary, and/or combined structures with rim elevations
- Proposed 100-year overland flow route

UTILITY PLAN SHEET

The utility plan sheets must delineate all existing and proposed utilities including sanitary, storm, water main, electric, gas or any others that exist on the **site**. Information regarding the invert and rim elevations, pipe sizes, pipe lengths, and material type must be provided.

Utility plan sheet(s) shall contain the following, as applicable:

- Benchmark location and information
- Existing **structures**, parking lots, driveways, sidewalks, pathways, trails, and other **impervious areas** on the **site**
- All top of foundation elevations for existing and proposed **structures**
- A unique line type to distinguish between proposed and existing sewer systems
- All proposed **qualified sewer construction** information including:
    - Qualified sewer manhole, cleanout or other **structure** information including diameter, and rim and invert elevation (each labeled by compass direction), with a unique and clearly labeled identifier
    - Qualified sewer labeled with length, size, material, and slope, delineated with a “proposed” linetype
    - Sewer invert elevation at the upstream **building** connection
    - Sewer invert elevation at any sewer or structure connection

  - ➢ Utility crossing information and call outs, including pipe-to-pipe clearance distance, for all water main and water service intersections along the proposed alignment
  - ➢ Qualified sewer manhole, **structure** lid cover type where appropriate (within HWL or **BFE**)

- All existing sanitary, storm, and **combined sewer** and associated **structure** information including pipe size, invert and rim elevation, flow direction, material type, and **ownership**
- All existing sanitary, storm, and **combined sewer** and **structures** to be demolished or abandoned, including septic systems, if not shown on **demolition** plan
- Reference to specific construction details, including:
  - ➢ Direct connections to **District** infrastructure
  - ➢ Drop manholes, doghouse manholes, or other specialty **structures**
  - ➢ Grease interceptors, triple basins, mud-basins, lint traps, acid neutralization basins, or other pre-treatment devices
  - ➢ Swimming pool drains and splash pads
- All existing and proposed sewer and water line vertical crossing elevations and horizontal separation dimensions
- All existing and proposed **stormwater facilities** including pipes, field tile, culverts, and inlets, including rim and invert elevations, pipe sizes, pipe lengths, and material type. When the proposed sewer does not impact or connect to the existing system, the location of the existing system must be shown at a minimum
- Location of all **major stormwater systems**, **volume control practices, detention facilities**, including **outlet control structures** and **HWL** delineation
- All proposed and existing downspout and sump pump discharge line locations and directions except for **residential subdivision development**
- Delineated limits of any **flood protection areas** on the **site**, including the **BFE** and **FPE** specified in accordance with §601 of the WMO
- Location and limits of all easements
- The plan and profile for public qualified sewer main construction shall also include the following, when applicable**:**

- Profile views or all proposed public qualified sewer main construction depicted on the same sheet as an accompanying plan view
- Profiles shall follow the alignment of public qualified sewer main construction if substantially different from the centerline of a **right-of-way** alignment
- Profile stationing to coincide with plan stationing
- **Structure** diameter, and rim and invert elevations (labeled by compass direction) for all proposed **qualified sewer construction** along with a unique identifier
- Horizontal and vertical scale
- Utility crossings with separation dimensions
- Existing ground profile (and bedrock when applicable)
- Match line when profile covers more than one plan sheet
- For large or complex projects, an insert map indicating immediate plan limits within the overall project

LIFT STATIONS AND FORCE MAINS

The lift station plan, profile, and schematic shall include the following, when applicable:

- Lift station and wet well plan and profile, including:
    - Critical pump operation elevations (pump off, pump on, etc.)
    - Pump installation elevation
    - **Structure** diameter and other relevant dimensions and elevations
    - Initial check valve and air/vacuum relief valve
- Force main profile, including:
    - Location of check valve(s)
    - Location of air/vacuum relief valve(s) and blowoff valve(s) along the alignment
    - Location of thrust blocks
    - Stream or **waterway** crossing(s) and crossing provisions

- Pump performance curve (indicating horse power, impeller size, efficiency) and system curve indicated operating point
- Lift station construction details

EROSION AND SEDIMENT CONTROL PLAN SHEET

The **erosion** and **sediment** control plan sheets contain information that is part of the **IEPA** Stormwater Pollution Prevention Plan (SWPPP), and includes the following:

- Locations of **erosion and sediment control practices**
- A statement that installation of **erosion and sediment control practices** will occur prior to any soil disturbance
- A schedule for construction activities, including **stabilized** construction entrance installation, **sediment** trapping facility installation, **site** clearing, stockpiling, grading, construction waste and concrete/mortar washout disposal, temporary and permanent **stabilization**, and removal of temporary **erosion and sediment control practices**
- A schedule for inspection, reporting, and maintenance of all erosion and sediment control practices
- Contact information for the party responsible for implementation and **maintenance** of the **site** soil **erosion** and **sediment** control plan

The plan sheets shall also contain design details for **proposed erosion and sediment control practices** the following information:

- Existing contours with drainage patterns and clearly delineated **watershed** boundaries tributary to the **site**
- Proposed contours, locations of **waterways**, and the location of **erosion and sediment control practices**
- Location of **flood protection areas** and vegetated areas for the **development** that are to be preserved or avoided
- Reference to specific **erosion and sediment control practice** details

CONSTRUCTION DETAILS

Construction details include sewer details, **erosion** and **sediment** control details, **stormwater facility** details, etc. These standard details are found in Appendix C of this **TGM** and also on the

District's WMO website, at wmo.mwrd.org. The standard details are available in both PDF and .dwg formats. Equivalent details may be submitted, and are subject to approval by the **District**.

DEVELOPMENT AREA EXHIBIT

The **development** area exhibit shall delineate all disturbed areas and indicate if areas are considered **development**, **maintenance**, and/or **demolition**. Areas that are considered **development** must be further delineated to indicate if any open space or **non-qualified development** is proposed.

DRAINAGE AREA EXHIBIT

The drainage area exhibit shall delineate the drainage areas tributary to the **major** and **minor stormwater systems**, including:

- Time-of-concentration path(s) and associated information
- All existing and proposed HGL elevations resulting from the **critical duration analysis** for the **major stormwater system** compared to the **lowest entry elevation** of any **structure**
- Delineation of pervious and impervious areas and their respective acreage and curve number and/or **runoff** coefficient
- Area tributary to all stormwater systems
- Delineation of any non-tributary and **unrestricted areas**
- Areas of the **parcel** tributary to offsite facilities
- Construction details and/or cross-sections of the major stormwater systems with the HGL and relevant dimensions and elevations
- A vicinity topographic map covering the entire upstream **watershed** that drains to or through the **site** and the entire **watershed** downstream to the point of known or assumed discharge and water surface elevation on the **site**

STORMWATER MANAGEMENT EXHIBIT

The **stormwater** management exhibit directly relates to the **development** area and **drainage area** exhibits, and may be shown on the same plan, if legible. This exhibit shall contain aspects relating to **runoff**, volume control and detention. The following general aspects shall also be included:

- All existing and proposed **volume control practices** and **detention facilities** in plan and cross-sectional view
- Delineated limits of the **HWL** for the 100-year, 24-hour storm event for new and/or adjacent **detention facilities**
- Location and limits of all easements
- Delineation of all pervious and impervious areas and their respective acreage and curve number and/or runoff coefficient
- Delineation of all **unrestricted areas,** including **native planting conservation areas**
- Delineation of all upstream tributary area with acreage and curve number and/or runoff coefficient
- Construction details for all proposed **stormwater facilities** including, but not limited to, **major and minor stormwater systems**, storage basins, **volume control practices**, **detention facilities**, and **outlet control structures**

FLOODPLAIN PLAN SHEET

The **floodplain** plan sheets must show the location of the existing and proposed **BFE** and **floodway**, as determined in §601 of the WMO and the previous *Floodplain Submittal Requirements* section. The **FPE**, top of foundation, and **lowest entry elevations** for existing and proposed **structures** shall also be specified, as appropriate. The plan sheets shall include the following:

- Topographic survey drawings of all existing and proposed **structures** located on or within 100 feet of the **site** including the **lowest floor**, **lowest entry elevation**, and **floodproofing** elevations
- Plan view of cross section locations utilized to compute **compensatory storage**, plotted at a scale such that quantities can be verified
- Cross section profiles of **floodplain** fill and **compensatory storage** with unique hatching and labeled identifiers
- Tabular summary of cut and fill volumes below the 10-year **flood** elevation
- Tabular summary of cut and fill volumes between the 10-year and 100-year **flood** elevations
- Any **outfalls** or sewers that cross a **waterway**

WETLAND PLAN SHEET

The **wetland** plan sheets must show the location of **wetlands** and **wetland buffers** on or within 100-feet of the **site**, based upon a survey of the **wetland** delineation in accordance with §603 of the WMO.

The area of any proposed impact to the **wetland** or **wetland buffer** shall be shown, and must include the mitigation plan, as detailed in the previous *Wetland Submittal Requirements* section. The following mitigation items shall be shown on the plan sheet(s):

- Soil type locations and soil management activities
- Delineation of any proposed buffer averaging
- Planting zones, species, quantities, sizes, locations, specifications, methodologies, and details
- Hydrology monitoring equipment locations
- Schedule of earthwork **stabilization**, planting, **maintenance**, and monitoring
- Temporary and permanent access locations
- Applicable **maintenance** and conservation easements granted or dedicated to, and accepted by, a governmental entity

RIPARIAN ENVIRONMENT PLAN SHEET

The **riparian environment** plan sheets must show the location of onsite **riparian environments**, based upon a survey of the **OHWM** of the channel or stream associated with it. Documentation must include a plan and profile of the existing and proposed channel showing the width, depth, sinuosity, and location of in-stream **structures**.

The area of any proposed impact to the **riparian environment** shall be shown, and must include the mitigation plan, as detailed in the previous *Riparian Environment Submittal Requirements* section. The following mitigation items shall be shown on the plan sheet(s):

- Delineation of any proposed buffer averaging
- Planting zones, species, quantities, sizes, locations, specifications, methodologies, and details
- Schedule of earthwork **stabilization**, planting, **maintenance**, and monitoring
- Temporary and permanent access locations

- Applicable **maintenance** and conservation easements granted or dedicated to, and accepted by, a governmental entity

PLAT OF SURVEY – EXHIBIT A

The Plat of Survey serves to show all **contiguous ownership**, including any **ownership** separated by **rights-of-way** or public easements, as these areas are considered **contiguous** under the WMO. When Schedule K or Schedule L is required, the Plat of Survey becomes the associated Exhibit A. When Exhibit A is submitted with Schedule L, it must also meet the recording requirements of Cook County.

The Plat of Survey must meet the boundary plat requirements of Section 1270.56 of Title 68 of the Illinois Administrative Code. It does not have to be dated immediately prior to permit submittal, but should be relatively recent enough to show existing **ownership** and current Property Index Numbers (PINs). Common items that should be shown on the Plat of Survey include:

- Total area in acres
- Boundary information, including length, bearing, and angle
- Location common name or address
- Legal description
- Parcel PIN
- Survey standard and benchmark information
- Easements, when applicable

RECORDING PLAN SHEET – EXHIBIT R

The recording plan sheet(s) make up Exhibit R, which is recorded with the Schedule R (see *Recording Submittal* under *Maintenance and Monitoring Plan Submittal Requirements* in the above section.) Exhibit R is intended to ensure the following systems, if applicable to the **development**, are permanently sustained and adequately maintained by future **parcel owners**. The recording plan sheet(s) must include the following:

- The common address, legal description, and Property Index Number (PIN) of the **parcel**
- Location of all existing and proposed **major stormwater systems**, **volume control practices**, and/or **detention facilities**

- Reference to required maintenance agreement(s) for any offsite **major stormwater system**, **volume control practices**, **detention facilities**, and/or private sewer connections not located on the **parcel** to ensure they are linked to the permitted **parcel development**

- Entire **parcel** area for phased **development** providing notice of **stormwater** detention storage requirements for undeveloped portions of a **parcel** now developed in part under the WMO

- Location of all **compensatory storage** areas provided to meet **District** mitigation requirements

- Location of all **wetland** and **riparian environment** mitigation areas provided to meet **District** mitigation requirements

- Location of all **native planting conservation areas**

- Location of all **qualified sewer construction**

- Type and schedule of **maintenance** activities to be performed on the existing and proposed systems, as indicated in the **Maintenance** and Monitoring Plan Submittal

Publicly financed projects are not required to record the Schedule R/Exhibit R, but must still provide the **maintenance** exhibit as part of the **Watershed Management Permit** submittal. Projects involving solely **qualified sewer construction** do not need to provide the Schedule R/ Exhibit R portion of the **Maintenance** and Monitoring Plan Submittal. However, when required for another reason, **qualified sewer construction** shall be made part of the Schedule R/Exhibit R.

POST-SUBMITTAL REQUIREMENTS

TERMS OF PERMIT/DENIAL – APPEAL

Upon receipt of a complete **Watershed Management Permit** application, meeting the submittal requirements set forth in the previous sections, the **District** or relevant **Authorized Municipality** may do any of the following:

- Request clarifications or revisions from the **applicant**
- Issue the **Watershed Management Permit**
- Issue the **Watershed Management Permit** with special conditions
- Deny the **Watershed Management Permit** application

Written comments requesting clarification or revision are transmitted to the design engineer within the timeframes specified in §1401.2 of the WMO. Once the **Watershed Management Permit** is issued, notification is sent to the **Permittee**, the **Co-Permittee**, the design engineer, and the **District** Field Inspectors.

Special Conditions that are made part of the **Watershed Management Permit** are generally considered to remain in effect for perpetuity. However, some Special Conditions require document submittal or testing within a set time period. These Special Conditions must be met prior to obtaining the RFI for permit close-out. Should a **Co-Permittee** wish to appeal a special condition or permit denial, they should follow the provisions of Article 13 of the WMO and this **TGM**.

CONSTRUCTION TIMELINE REQUIREMENTS

Construction activities under a **Watershed Management Permit** must be initiated within one (1) year of permit issuance. If construction has not started within one (1) year, the permit may be considered null and void. To avoid this, a request for extension may be submitted to keep the **Watershed Management Permit** active.

Construction activities must be complete within three (3) years of permit issuance for WMO Permits, FCA, SFHA Permits, and Permit Revisions, and two (2) years for NRIs. Earthwork Permits expired based on the required submittal of the related WMO Permit, as listed on the Earthwork permit application. If construction is not complete within the appropriate expiration date, a request may be made to the **District's** Field Office or **Authorized Municipality** who originally issued the **Watershed Management Permit** for a time extension.

For publicly financed projects that experience delay due to court proceedings, the one (1) year period to start construction will be considered from the date of final court action.

The **District** or **Authorized Municipality** will review all requests to determine if a time extension is warranted and if the **Watershed Management Permit** should remain active. Additional information on Permit Extensions is found in the following section.

PERMIT EXTENSIONS

Watershed Management Permits have expiration dates, as listed in the above section. To avoid rendering a permit null and void, the **Permittee**, **Co-Permittee**, or their design engineer may send a request for Permit Extension. An extension may be granted for an additional year to start construction. In some circumstances, an additional one (1) year extension may be granted. Regardless of when **start of construction** occurs, all construction must be complete within three (3) years of the permit issue date for WMO Permits, FCAs, SFHA Permits, and Permit Revisions. All construction must be complete within two (2) years for NRIs, and Earthwork Permits have an expiration tied to the receipt of a full WMO Permit.

Once construction has begun, an extension is not required unless construction will not be completed within three (3) years of the permit issue date. Requests for permit extensions in these scenarios should be directed to the **District's** Field Office.

Extensions to the above expiration dates may be granted by the **District** or **Authorized Municipality** that originally issued the **Watershed Management Permit**. The **applicant** shall submit written request for consideration. Each case will be evaluated to determine if an extension should be granted. Extensions are generally granted in one-year increments, unless specified otherwise in the written request.

APPROVAL OF PLAN REVISIONS

After issuance of a **Watershed Management Permit**, all **material revisions** to the plans, Schedules, or permit forms require approval of either the **District** or the **Authorized Municipality** that originally issued the permit. The **applicant** shall submit a written request for approval, along with the revised plans, Schedules, and permit forms. Submittal requirements for a Permit Revision are detailed under the *Permit Revision* permit type section in this Article of the **TGM**.

Should the **District** or the **Authorized Municipality** determine that the revised plans are in compliance with the current WMO requirements, the Permit Revision will be issued and the revised work may commence. Construction of revised work without an approved Permit Revision is deemed construction without a permit and is subject to violation, per Article 12 of the WMO.

If the **material revisions** to the permit are minor in nature, they may be approved via a Field Change, and documented on the Record Drawings. The **District's** Field Office staff or the **Authorized Municipality Enforcement Officer** may issue Field Changes that do not require a formal Permit Revision. Fees associated with Field Changes shall be paid prior to issuance of the RFI.

RECORD DRAWINGS

Upon completion of construction, **record drawings** must be prepared, signed, and sealed by a professional engineer or professional land surveyor, and shall represent the final "as-built" conditions of topography, elevations, structures, **major stormwater systems**, **volume control practices**, **detention facilities**, **compensatory storage**, **flood protection areas**, and **qualified sewer construction**. All **record drawings** must contain benchmark information and reference a vertical datum. Calculations for as-built storage volumes must also be included as part of the **record drawing** submittal, and must be signed and sealed by a **professional engineer**.

The submittal shall include four copies of the **record drawings** and must be submitted prior to or concurrently with the Request for Final Inspection (RFI). The **record drawings** shall be sent to the **District** or **Authorized Municipality** that originally issued the **Watershed Management Permit**. Submittals to the **District** should be directed to the Local Sewer Systems Section Field Office at the following address:

Metropolitan Water Reclamation District
Local Sewer Systems Field Office
Stickney Water Reclamation Plant
6001 West Pershing Road
Cicero, IL 60804

When construction activities include a direct connection to or modifying/replacing/relocating **District** infrastructure, or similar activity, the following items must be submitted to the **District** with the RFI:

- Six (6) copies of **record drawings** and with rim, invert, and other relevant dimensions and elevations. All elevations shall reference North American Vertical Datum of 1988 (NAVD 88).

- A compact disk (CD) containing a shape file with the as-built GPS coordinates and all rim, invert, and other relevant dimensions and elevations. All GPS coordinates shall reference Illinois State Plane North American Datum 1983 (NAD 83) and all elevations shall reference North American Vertical Datum of 1988 (NAVD88).

If it is determined that the constructed grades, geometries, storage volumes, or inverts are not in conformance with the approved plans, the **applicant** shall be responsible for any modifications required to bring the **site** in compliance with the WMO.

RECORDING OBLIGATIONS

Per §307.1, the **applicant** is responsible for ensuring the Schedule R and Exhibit R are recorded with Cook County. The as-built Exhibit R is the version that must be recorded. If there are no changes during construction, the originally approved Exhibit R may be recorded. The recording submittal must meet the requirements of Cook County, as indicated above.

Recording occurs after construction is substantially complete. An as-built Exhibit R should be prepared, showing any changes from the originally approved Exhibit R. The Recordation Submittal must meet the recording requirements set forth by Cook County. The **District** has no influence on the policies and procedures of Cook County, and can only provide guidance based on past recording experience. At the time of this writing, the following must be submitted to Cook County in order to record the Schedule R/Exhibit R:

- One (1) originally signed Schedule R attached to the as-built Exhibit R
- Seven (7) photocopies of the Schedule R and as-built Exhibit R
- A full legal description attached to each Schedule R in at least 12-point font
- Contact information and address to send the recorded copy
- Any recording fees required by Cook County

Upon recordation, one (1) copy of the recorded documents must be sent to the **District's** Local Sewer Systems Section Field Office, located at the Stickney WRP. The RFI for the permit will not be issued until the recorded Schedule R/Exhibit R is received. At such time, the **District** will initiate refund procedures for the Recordation Deposit.

At the expense of the **applicant**, the **District** may record the Schedule R/Exhibit R as a last resort prior to pursuing a violation for not meeting the above requirement.

There are instances in which the entire **Watershed Management Permit** may be recorded against the parcel. Cases of this include **Sole Permittee** permits, permits with no stormwater **permittee**, or any other reason indicated by the **Director of Engineering**.

The obligations imposed under the recorded documents shall continue in perpetuity, or until the parcel is redeveloped under a new **Watershed Management Permit**.

TGM ARTICLE 3 REVISION TABLE

No.	Revision Description	Date
0	Original TGM	5/1/2014
1	Schedule applicability, sole permittee requirements, flowchart/checklist updates	8/1/2015
2	Revision table, remove flowcharts/checklists, Amendment updates, rewrite	10/16/2018

ARTICLE 4: EROSION AND SEDIMENT CONTROL

Introduction

Controlling **erosion** and **sedimentation** during construction activities is critical in preventing negative impacts to water quality and local drainage systems. **Development** activities involving earth work, such as clearing, grubbing, grading, filling, and installing utilities, remove existing protective vegetative cover and expose soils to excessive **erosion**. The rate of **erosion** dramatically and unnaturally increases when soils are left unprotected during **development** or construction activities. Unprotected **sites** can erode at a rate in excess of one hundred times the natural rate of **erosion**. As shown in Figure 4.1, **sediment** can be carried from the project **site** in **stormwater runoff**, which results in the accumulation of **sediment** in **storm sewers**, **waterways**, **detention facilities** and other drainage features.

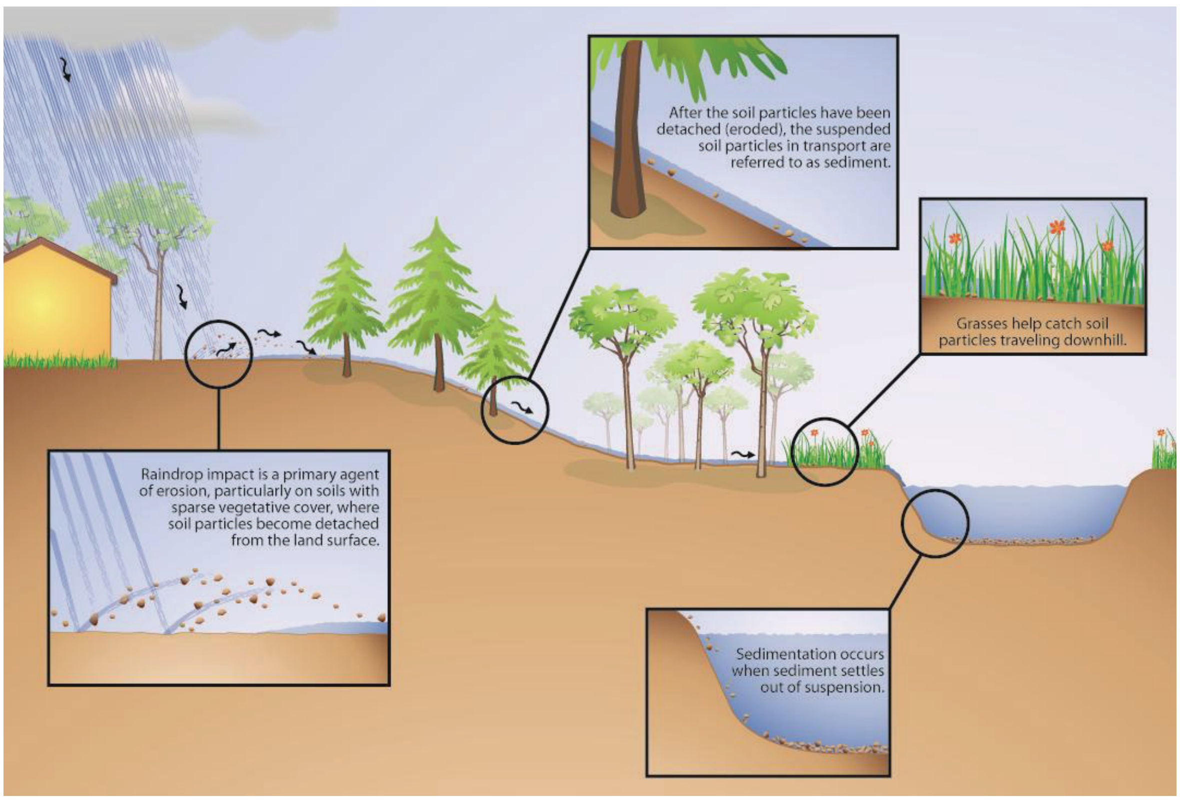


Figure 4.1 Erosion, Sediment, and Sedimentation

The accumulation of **sediment** reduces **stormwater** conveyance and the storage functions of streams, **wetlands**, **storm sewers, detention basins**, highway drainage ditches, **floodplains**, and navigable water channels. These impacts can result in more frequent and/or severe **flooding**. **Sedimentation** can also impact the storage capacity of municipal and industrial water supply reservoirs and increase costs due to the need to filter muddy water in preparation for domestic

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

or industrial use. It is also expensive to remove **sediment** from **storm sewers**, **detention facilities**, and other drainage systems. Excessive **sediment** in water bodies can be detrimental to aquatic life since it interferes with respiration, growth, reproduction, oxygen exchange and photosynthesis in plants.

Due to the many adverse environmental and economic impacts that result from **sedimentation**, the **Watershed Management Ordinance** (WMO) requires soil **erosion and sediment control practices** for all **development**. The purpose of these practices is to minimize and prevent pollution impacts during the construction phase of **development**. These practices are often referred to as Best Management Practices (BMPs). BMPs are measures that can be done on a small scale (individual **development sites**) that, in the aggregate, are designed to address the large scale objective of improving water quality throughout the **watershed**.

WMO Erosion and Sediment Control Requirements

The WMO requires all **developments**, regardless of size, to install and maintain soil **erosion** and **sediment** control measures during construction to prevent and/or reduce the **sediment** in **stormwater runoff** leaving the **site**. The **erosion** and **sediment** control requirements in the WMO are generally based on the general **National Pollutant Discharge Elimination System** (**NPDES**) Permit for **Stormwater** Discharges from Construction **Site** Activities (General **NPDES** Permit ILR-10). All **developments** that are equal to or greater than one acre in size must comply with the **Illinois Environmental Protection Agency** (**IEPA**) **NPDES** requirements for construction activities. For those **developments** located in a **combined sewer area**, if all **site stormwater** discharges, including construction dewatering, drain to a **combined sewer system**, ILR-10 permit coverage is <u>not</u> required.

The WMO requires **erosion and sediment control practices** on all **development sites**, regardless of the acreage of land disturbance or if it is located in a **combined** or **separate sewer area**. The WMO requires an **Erosion** and **Sediment** Control Plan to be prepared and submitted on all **development** projects requiring a **Watershed Management Permit** (§301.7). With every **Watershed Management Permit** application, a completed Schedule P form must be included with the submittal.

Although **erosion and sediment control practices** are required for every **development** regulated under the WMO, Schedule P is not required for certain types of **development**, including:

- Utility trenches not in **flood protection areas**;
- Projects undertaken solely by the **District**; and
- **Development** activities listed in WMO §201.1 that are undertaken solely by state or federal agencies (**IDOT**, Illinois Tollway Authority, **Corps**, etc.).

The WMO provides requirements for:

1. Temporary **erosion** control (§401);
2. Temporary **sediment** control (§402);
3. Construction **site** management (§403); and
4. Permanent **stabilization** (§404).

The **erosion and sediment control practices**, design criteria, and specifications in the WMO are generally based on the ***Illinois Urban Manual***. The ***Illinois Urban Manual***, which was originally developed by the US Department of Agriculture (USDA) – **Natural Resources Conservation Service** (**NRCS**), is considered to be the foremost resource for the selection and design of soil **erosion** and **sediment** control measures. When criteria and specifications are not provided in the ***Illinois Urban Manual***, the design criteria and specifications provided in the **TGM** shall be used (§400.6). In circumstances where other **erosion and sediment control practices** that are equally effective as those in the ***Illinois Urban Manual*** or those included in the **TGM** are to be used, prior written approval must be obtained from the **District** (§400.7).

A copy of the ***Illinois Urban Manual*** is available on-line through the Association of Illinois Soil and Water Conservation **District**s (AISWCD) website at: http://www.aiswcd.org/IUM/.

All standard drawings from the ***Illinois Urban Manual*** are available for download in pdf, dxf, dwf, and dwg file formats at: http://aiswcd.org/IUM/listdraw.html.

In addition, standard **erosion** and **sediment** control notes are available on-line through the **US Army Corps of Engineers** (**Corps**) website at:
http://www.lrc.usace.army.mil/Portals/36/docs/regulatory/pdf/SESCrec.pdf

The WMO requires that for all **developments** discharging directly to **Jurisdictional Waters of the US**, the hydraulic and hydrologic design of the **erosion** and **sediment** control plan shall be designed for a **storm event** equal to or greater than a 25-year, 24-hour **storm event** (§400.4).

It should be understood that **development sites** have unique **stormwater runoff** situations and that the application of **erosion and sediment control practices** vary from **site** to **site**. Each type of **erosion and sediment control practice** has certain limitations based on the **drainage area** served, available land space, cost, and pollutant removal efficiency in addition to a variety of **site**-specific factors such as soil types, slopes, and depth of **groundwater** table. Careful consideration of these factors is necessary in order to select the appropriate **erosion and sediment control practice**. As stated in §400.3, all **developments** must address **erosion** and **sediment** control and the following:

1. Incorporate **erosion and sediment control practices** into the initial **site** plan;

2. Place a primary emphasis on **erosion control practices** that minimize **erosion**; and

3. Place a secondary emphasis on **sediment control practices** that contain eroded soil after it is in transport.

DEVELOPMENT OF AN EROSION AND SEDIMENT CONTROL PLAN

As part of the WMO submittal requirements, applicants need to develop an **erosion** and **sediment** control plan (§302.2). The ***Illinois Urban Manual***, Section 3, outlines a nine-step planning process recommended for the **development** of an **erosion** and **sediment** control plan and provides a list of pre-planning activities. At a minimum, **site erosion** and **sediment** controls and overall **site** management should conform to the following:

1. Control **stormwater** volume within the **site** to minimize soil **erosion**;

2. Control **stormwater** discharges, including both peak flowrates and total **stormwater** volume, to minimize **erosion** at outlets and to minimize downstream channel and stream bank **erosion**;

3. Minimize the amount of soil exposed during construction activity;

4. Minimize the disturbance of steep slopes;

5. Minimize **sediment** discharges from the **site**;

6. Address factors such as the amount, frequency, intensity, and duration of precipitation, the nature of resulting **stormwater runoff**, and soil characteristics, including the range of soil particle sizes expected to be present onsite;

7. Provide and maintain natural buffers around surface waters, direct **stormwater** to vegetated areas to increase **sediment** removal and maximize **stormwater** infiltration (unless infeasible); and

8. Minimize soil compaction and unless infeasible, preserve topsoil

For purposes of the WMO, an **erosion** and **sediment** control plan must describe all measures appropriate for the **development** such that all the requirements of Article 4 are met. In addition, the **erosion** and **sediment** control plan should put emphasis on avoiding sensitive areas and minimizing the amount and duration of soil exposed to **erosion** by wind, rain, **runoff** and vehicle tracking. Effective planning includes the **development** of a schedule for implementing appropriate **erosion control practices**, **sediment control practices**, and construction **site** management practices that control pollution generated from construction activities.

The plan sheet(s) require the associated details and staging construction plans, where applicable. Some **sites** may require unique details to describe **site**-specific **erosion control practices** and **sediment control practices** and applications. Typically, a **site** grading plan will be utilized as the base for the **erosion** and **sediment** control plan sheet(s) as it is necessary to locate limits of **disturbed areas** and discharge points when designing the **erosion** and **sediment** control plan sheet(s).

The **erosion** and **sediment** control plan sheet(s) apply to all areas that are directly related to the project's construction activity, including but not limited to staging areas, storage yards, material borrow areas, storage areas, and access roads. The **erosion** and **sediment** control plan must provide controls for existing, interim, and proposed conditions. Also, the **erosion** and **sediment** control plan sheet(s) must ultimately reflect the contractor's phasing and/or construction staging, and must address the entire scope of the contract work.

Components of Erosion and Sediment Control Plan

As described in §302.2, the **erosion** and **sediment** control plan shall include the following:

1. "A narrative description of the existing land cover, hydrologic conditions of the proposed **development**, upstream **tributary area** and areas adjacent to the **development** including a description of any **Flood Protection Areas**, **site** discharge location(s), points of discharge to **Jurisdictional Waters of the U.S.**, and soil survey data." (§302.2A)

   This paragraph(s) narrative should include a discussion of the existing conditions of both the **development** and the areas adjacent to the **development** that can be impacted by **erosion** or **sedimentation**. Soil data for the county can be obtained on-line through the **NRCS** at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

   It is recognized that soil data may not be available for some areas of **Cook County**. If data is not available, then it should be noted in the narrative.

2. "The **NPDES** ILR-10 permit number issued by **Illinois Environmental Protection Agency** (**IEPA**) to the applicant upon submittal of the ILR-10 Notice of Intent permit application or permit." (§302.2B)

   After the application has been submitted and reviewed by **IEPA** for completeness, an identifying ILR-10 number is assigned to the permit application and the Notice of Intent (NOI) will be published to the NOI page(s) of **IEPA's** website. The NOI and identifying ILR-10 permit number should be noted on the Schedule P form.

3. "A narrative description of the proposed temporary **erosion and sediment control practices**, including a narrative describing how **Flood Protection Areas** will be protected from **erosion** and **sedimentation**." (§302.2C)

   This narrative should include a description of the temporary **erosion control practices**, the temporary **sediment control practices** selected for the **development**, and how these practices will be used to protect **Flood Protection Areas**.

4. "A schedule of construction activities including, but not limited to, clearing and grading, installation of **stabilized** construction entrances, **erosion and sediment control practice** implementation, disposal of construction waste, stockpiling, and inspection and **maintenance** of all **erosion and sediment control practices**." (§302.2D)

   The schedule should allow adjustments in implementation of **erosion and sediment control practices** based on factors such as potential weather and the pace of work progress. The schedule should provide for the monitoring of weather forecasts for rainfall and adjust installation of **erosion and sediment control practices** prior to predicted rainfall events or dry-spells. The schedule should incorporate staged seeding and re-vegetation of graded slopes as work progresses.

   Apply permanent **erosion** control to areas deemed substantially complete during the project's defined seeding window. The schedule should include a monitoring program consisting of regular inspection of **erosion and sediment control practices** to ensure proper installation, **maintenance**, and performance of implemented **structures** and procedures. Objectives and **maintenance** schedules should be adjusted based on the results of monitoring and changes in construction plans.

5. "Data and calculations used to size, locate, design, and maintain all **erosion and sediment control practices**, and the design of temporary stream crossings." (§302.2F)

   All calculations, data, and assumptions used for the sizing and placement of **erosion and sediment control practices** should be included in the plan. This information should demonstrate how the proposed **erosion and sediment control practices** have been designed in compliance with the regulations in the WMO and/or **NPDES** ILR-10 permit.

6. "A mechanism for ensuring that the **erosion** and **sediment** control installation and **maintenance** requirements for both temporary and permanent measures will be met, including the list of **maintenance** tasks and performance schedules that have been identified and/or required in the plan sheet(s) and specifications." (§302.2G)

   In accordance with ILR-10, onsite inspections must be completed regularly and also after **storm events** that result in 0.5 inches or more rainfall. An assessment should be made on whether the onsite soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. Any **maintenance** that is required should also be identified as part of this process. Additional guidance on **maintenance** of soil **erosion** and **sediment** controls is provided in Article 9 of the **TGM**.

General NPDES Permit ILR-10 Requirements

The goal of General **NPDES** Permit ILR-10 is to protect the quality and beneficial uses of the State's surface water resources from polluted **stormwater runoff** and from non-**stormwater** discharges associated with construction activities. To achieve this goal, the ILR-10 requires **permittees** to plan and implement appropriate pollution prevention and control practices for **stormwater runoff** and non-**stormwater** discharges throughout construction. These BMPs are aimed at reducing **erosion**, controlling **sediment** transport, implementing good housekeeping practices, and minimizing pollutant discharges. As stated previously in this article, for those **developments** located in a **combined sewer area**, if all **site stormwater** discharges, including construction dewatering, drain to a **combined sewer system**, ILR-10 permit coverage is <u>not</u> required.

A copy of General **NPDES** Permit ILR-10 is Available at:
http://www.epa.state.il.us/water/permits/storm-water/construction.html

Notice of Intent

To receive authorization under the ILR-10 Permit, a discharge must either be covered by a valid Illinois General **NPDES** Construction **Site** Permit, or a completed Notice of Intent (NOI) in accordance with Part II (NOI Requirements) and Part VI.G (Signatory Requirements) of the ILR-10 Permit. The NOI must be submitted in sufficient time to allow a 30 day review period after receipt of the NOI by **IEPA** and the **start of construction**. Dischargers who fail to notify the **IEPA** of their intent to be covered, and discharge **stormwater** associated with construction **site** activity to Waters of the State without an **NPDES** permit, are in violation of the Environmental Protection Act and the Clean Water Act.

Construction activities that are operating under approved local **sediment** and **erosion** control plans, land disturbance permits, grading plans, or **stormwater** management plans, shall also submit signed copies of the NOI to the local agency approving such plans in accordance with the deadlines set forth in Part II.A of the ILR-10 permit. A copy of the NOI shall be sent to the entity holding an active General **NPDES** Permit No. ILR-40 if the project is located in an area covered by an active ILR-40 permit.

Additional NOI guidance is available on-line through the **IEPA** at:
http://www.epa.state.il.us/water/permits/storm-water/construction.html

Storm Water Pollution Prevention Plan (SWPPP)

A SWPPP is required for **developments** that will result in the disturbance of one or more acres of total land area, or for a **development** less than one acre of total land that is part of a larger common plan of **development** or sale, if the larger common plan will ultimately disturb one or more acres of total land area. The SWPPP is an integral part of the **IEPA**'s ILR-10 permit program, and plays a crucial role in minimizing the pollution of **stormwater runoff** from construction **sites**. A properly prepared and implemented SWPPP assists permitees with meeting **stormwater** pollution prevention goals. The **erosion** and **sediment** control plan alone should not be considered a SWPPP, rather one component of the **site** specific SWPPP.

The US Environmental Protection Agency (EPA) has published a guide to developing SWPPPs for

construction **sites**. The guide is available on-line at:
http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

An example SWPPP for a small (5-acre) construction **site** is available in pdf form on-line at: http://www.epa.gov/npdes/pubs/exampleswppp_smallcommercial.pdf.

An example SWPPP for a medium-sized (20-acre) construction **site** is available in pdf form on-line at: http://www.epa.gov/npdes/pubs/exampleswppp_residential.pdf.

Inspections

In accordance with the WMO (§1000.4), inspections must be performed to verify that the **development** is in compliance with the soil **erosion** and **sediment** control requirements of the WMO. An initial inspection of soil **erosion** and **sediment** control measures should occur after mobilization and installation of initial **erosion and sediment control practices**, prior to any soil disturbance (§1000.4A).

In accordance with ILR-10 regulations, inspections must be conducted at least once every seven calendar days and within 24 hours of the end of a storm, or by the end of the following business or work day, that is 0.5 inches or greater.

Inspections may be reduced to once per month when construction activities have ceased due to frozen conditions. Inspections must commence when construction activities are conducted, if there is a 0.5 inches or greater rain event, or if discharge due to snowmelt occurs.

An assessment should be made and documented in a report on whether the soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. All remedial actions taken to repair or install soil **erosion** and **sediment** controls should be completed within 7 days of their discovery, unless the repair or installation is resulting in a pollutant discharge, in which the remedial action must occur immediately. For additional guidance on inspections, refer to Article 10 of the **TGM**.

TEMPORARY EROSION AND SEDIMENT CONTROL (§401 - §402)

Overview

Erosion and sediment control practices are techniques, measures or structural controls used for a given set of **site** conditions to manage the rate, quantity, and quality of **stormwater runoff** in a cost-effective manner. No single practice can address all pollutants associated with construction activities. Independently these practices serve different purposes. **Erosion** controls are preventative strategies that utilize techniques to stabilize the soil, thus minimizing the occurrence of **erosion**. **Sediment** controls are back up strategies that incorporate structural measures to contain **sediment** on **site** in the event that **erosion** does occur. While functionally different, these two forms of pollution control should be selected and implemented in a complimentary manner in order to maximize pollution prevention effectiveness.

The selection process for temporary **erosion and sediment control practices** is an iterative process that first identifies potential pollutant sources and then identifies the measures necessary to reduce or eliminate pollutant discharges from the **site**. The nature and extent of the **erosion and sediment control practices** should be appropriate to address the specific conditions of the **site** and be properly maintained to ensure continued effective operation. For each aspect of construction, the placement of the necessary measures should be timed to optimize their effectiveness.

Temporary **erosion and sediment control practices** should reflect the features and limitations of the **development site** and adjacent properties. The following must be considered:

1. Seasonal, topographic, and **maintenance** limitations;

2. The susceptibility of soils to **erosion**;

3. Amount of tributary **drainage area**; and

4. Proximity to **Flood Protection Areas**.

Examples of seasonal, topographic, and **maintenance** limitations may include seeding windows, steep slopes, and accessibility. Available soil survey information and **site** investigation should be used to understand the potential susceptibility of **site erosion** of unprotected soils. Soil investigation should also include an understanding of infiltration capability, soil textural classes (percent sand, silt, and clay), as well as an understanding of the depth to seasonally high water table, bedrock, or other limiting layer. A description of these **site** soil features are required in the **development** of the volume control plan (§303), and can also facilitate the **development** of the temporary **erosion and sediment control practices**.

Avoiding Disturbance to Sensitive Areas

Construction schedules and planning should include all practicable measures to avoid disturbances to environmentally and culturally sensitive and regulated areas. Sensitive areas may include, but are not limited to, steep slopes, highly erodible soils, streams, stream buffers, specimen trees, and natural vegetation. Other sensitive areas include **Flood Protection Areas** (i.e., **floodplains**, **wetlands**, and **riparian environments**), threatened and endangered species habitat, historic preservation **sites**, and EPA 303(d) listed receiving waters. These areas provide numerous water quality and **flood** protection benefits and therefore require special management and protection in order to preserve their functions.

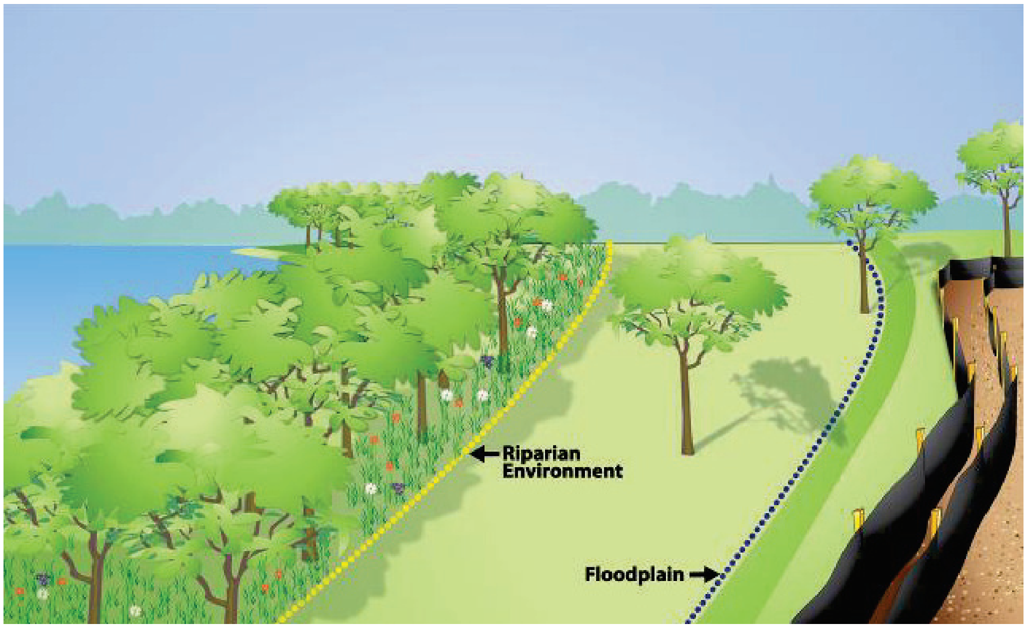


Figure 4.2 Example of a Double Row Silt Fence Protecting a Flood Protection Area

Flood Protection Areas

The WMO requires that soil stockpiles or other construction materials are not located within **Flood Protection Areas** (**FPAs**), and that they be protected by a minimum of a double-row **silt fence** or equivalent measure, as shown in Figure 4.2. Additional **erosion and sediment control practices** should be employed as necessary to protect **FPAs** from negative impacts associated with **development**. Stockpiles should never be placed within **FPAs** in order to prevent **sediment**-loading, impairment of ecological functions, and restriction of conveyance during **storm events**. The implementation of preventative measures prior to construction, such as the preservation of vegetated buffers, use of fencing and signage, and avoiding disturbances near **FPAs**, are some of the most effective means of protection.

Floodplains

Floodplains safely convey floodwaters and dissipate flows and velocities, subsequently reducing streambank **erosion** and protecting **structures** and people from the effects of **flooding**. Protection of **floodplain** corridors also promotes connectivity of habitat, which encourages the spread of native plants and wildlife.

Wetlands

Wetlands and **wetland buffers** are important **stormwater** management assets, where biogeochemical interactions cleanse surface and subsurface water of pollutants. Decreased flow velocities in **wetlands** allow **sediment** to settle out of suspension, and **wetland** vegetation provides the surface area and energy sources necessary for microorganisms to break down and immobilize pollutants. **Wetlands** also provide **stormwater** attenuation and volume reduction benefits by detaining surface waters, which alleviates **flooding**, promotes evapotranspiration, and allows recharge of **groundwater** aquifers. **Wetlands** can also offer protection from

erosion, sequester atmospheric carbon dioxide into organic soils, and provide plant and wildlife habitat.

Riparian Environments

Riparian environments provide ecosystem services in the form of streambank **stabilization**, interception and immobilization of **sediment**, sequestration of nutrients, metals, organic compounds, and other pollutants, and also enhancement of biodiversity in this transitional zone. **Riparian environments** also provide **stormwater** management benefits, since the vegetated and wooded areas adjacent to streams can reduce **flood** velocities and flowrates. These areas can also provide volume reduction benefits through infiltration in the vegetated areas.

TEMPORARY EROSION CONTROL REQUIREMENTS (§401)

Erosion control practices involve the **stabilization** of soil in order to alleviate raindrop impact, prevent sheet and rill **erosion**, prevent suspension of solids in **stormwater runoff**, and prevent dust due to wind **erosion**.

Temporary **erosion control practices** are **stabilization** measures including, but not limited to:

- Protection of existing vegetation;
- Establishment of new vegetation;
- Soil **stabilization** measures;
- Wind and dust control measures;
- **Stormwater** conveyance channels; and
- Velocity dissipation measures.

When selecting **erosion control practices**, it is important to consider both onsite and offsite conditions. All potential sources of **erosion** should be evaluated and optimal methods should be chosen based upon the combination of soil characteristics, topography, climate, existing resources, proposed construction activities, and proximity to **FPAs**. Preservation of existing vegetation should always be considered as a primary method of soil **stabilization**, due to present and future value for **erosion** protection, **sediment** control, wildlife habitat, landscape aesthetics, and economic value. Implementing preventative measures early in the project timeline can save cost and time during later phases by reducing the need for supplemental **stabilization** and **sediment** containment practices.

Erosion control practices should be removed as soon as practicable, but no longer than seven days after construction activities have temporarily or permanently ceased. As stated in the ILR-10 permit, this requirement may be waived if construction activity is scheduled to resume within 14 days from when activities ceased.

A listing of ***Illinois Urban Manual*** drawings for recommended temporary **erosion** control measures is provided in Table 4-1.

Protection of Existing Vegetation and Site Soil Disturbance Activities

Vegetation can be an effective and economic method of soil **stabilization**. Vegetative cover protects soils from raindrop impacts, rill and sheet **erosion**, and wind **erosion**. Vegetation also provides a reduction in velocity, valuable filtration and adsorption of pollutants, and can reduce **runoff** volumes by enhancing infiltration. The WMO states that existing vegetation shall be preserved where practicable to minimize the area of soil disturbance (§401.1). The purpose of retaining existing vegetation is to temporarily preserve areas that have value for **erosion** control during the construction process.

Preservation of existing vegetation is also a simple way of maintaining **stabilized** soils in areas of the **site** where no construction activity is planned or will occur at a later stage, phase, or date.

In addition to preservation of existing vegetation, the following general guidelines relating to soil disturbing activities should also be followed:

1. Minimize the area of soil exposed to **erosion** at one time;

2. Schedule major grading operations for the non-rainy season when practicable and limiting soil disturbing activities during the rainy season; and

3. Sequence trenching activities so that most open portions are closed before new trenching begins. Also any trenches, holes, or other excavations required for utility installation should be protected at the end of each workday.

Establishment of New Vegetation

As stated above, vegetation can be an effective and economic method of soil **stabilization**. Similar to preservation of existing vegetation, establishing temporary or permanent vegetative cover on disturbed or exposed areas reduces **erosion** and creates a landscape that enhances soil permeability and the filtering of **runoff** pollutants.

Soil Stabilization

Soil **stabilization** measures are manufactured products that protect against raindrop impact and enhance vegetative establishment by retaining soil moisture, providing an insulating layer, preventing seed washout, controlling weedy species, and protecting seeds from wildlife consumption. These products include mulches, soil binders, **erosion** control blankets, and turf reinforcement mats, which provide effective and immediate **stabilization** of slopes and channels before, during, and after the establishment of vegetation.

Wind and Dust Control

The purpose of this practice is to prevent blowing and movement of dust from exposed soil surfaces, to reduce on and offsite damage, to minimize health hazards, and to improve traffic safety. This practice is applicable to areas subject to dust blowing and movement where on and offsite damage is likely without treatment.

Stormwater Conveyance Channels

Stormwater conveyance channels prevent **erosion** by redirecting potentially erosive flows or convey clean or **sediment** laden water from upstream **tributary areas** along a **stabilized** path and away from areas that have not yet been **stabilized**. These include diversion dikes, drainage swales, lined ditches, and slope drains. **Stormwater** conveyance channels are not suitable as **sediment**-trapping devices, and should be **stabilized** prior to use to prevent **erosion** of exposed soils.

Velocity Dissipation Measures

Velocity dissipation measures prevent **erosion** by slowing the velocity of concentrated flows at the **stormwater outfall**. These measures are to be employed wherever concentrated flows are conveyed at erosive velocities, such as in steep swales or at pipe outlets. These consist of an area or apron of rock, concrete rubble, or gabions placed at the outlet of a drainage system. Appropriate applications include, outlets carrying a continuous flow of water, outlets subject to short, intense flows, outlets to **sediment basins**, and points where lined channels discharge to unlined channels or natural **waterways**.

Erosion and Sediment Control for Construction Shutdown or Phased Projects

The WMO requires that temporary **erosion control practices** be maintained on a year-round basis during construction (§401.5). Temporary **erosion control practice** are required for any periods of construction shutdown until permanent **stabilization** is achieved (§401.5).

All open areas that are to remain idle throughout winter should be **stabilized** with temporary or permanent vegetation prior to the end of the fall growing season. Seeding should be performed during the appropriate season in order to ensure rapid establishment of vegetation. In the event that temporary or permanent re-vegetation cannot be established prior to winter shutdown, a backup **stabilization** and containment plan should be in place in order to implement additional **erosion** control measures, such as the installation of mulch or **erosion** control blankets on all exposed soil. **Sediment control practices**, such as perimeter **silt fence** and **storm sewer** inlet protection devices, should also be installed and maintained throughout the winter shutdown period.

Table 4-1. *Illinois Urban Manual* Drawings for Temporary Erosion Control Strategies

Temporary Erosion Control Strategy	*Illinois Urban Manual* Code
Protection of Existing Vegetation	
Tree and Forest Ecosystem Preservation	984
Establishment of New Vegetation	
Temporary Seeding	965
Permanent Vegetation	880
Sodding	925
Erosion Control Blanket	830
Mulching	875
Wind and Dust Control Measures	
Dust Control	825
Stormwater Conveyance Channels	
Diversion Dike	820
Temporary Diversion	955
Temporary Slope Drain	970
Temporary Swale	980
Temporary Pipe Diversion	676-PD
Velocity Dissipation Measures	
Rock Outlet Protection	910

For projects involving phased construction, within the portions of the **site** where construction activities will be temporarily ceased, **stabilization** practices must be completed within seven days unless construction activity is resumed on that portion of the **site** within 14 days (§401.6). The WMO allows for the instances where snow cover precludes the completion of the **stabilization** practices. In such cases, the **erosion control practices** must be completed as soon as practicable.

TEMPORARY SEDIMENT CONTROL REQUIREMENTS (§402)

Sediment-laden waters generated onsite should be routed through at least one **sediment control practice** prior to discharge (§402.3). These practices are designed to contain or filter **sediment**-laden **runoff** (eroded material) before it leaves the **site**. Most **sediment control practices** function by reducing flow velocity and turbulence of **sediment**-laden water, subsequently allowing **sediment** to settle out of suspension. In some instances, multiple **sediment control practices** will be necessary to protect against the discharge of suspended **sediment**. All **sediment control practices** should be installed in conjunction with **erosion control practices**, and therefore should not be utilized as stand-alone measures. A listing of

Illinois Urban Manual drawings for recommended temporary **sediment** control measures is provided in Table 4-2.

Sediment control practices must intercept all **runoff** from **disturbed areas** before **runoff** leaves the **site** (§402.5). When the **disturbed area** or areas constitute an area draining less than one acre, then the **disturbed area** must be protected by a minimum of a **silt fence** or equivalent. For a **silt fence** equivalent, refer to the following section, Perimeter Controls. Equivalent measures should be used only when approved by the **District**.

When the **disturbed area** or areas constitute an area draining more than one acre, then the **disturbed area** must be protected by a **silt fence** (or equivalent) and a **sediment basin** or equivalent. The **sediment basin** must be sized to intercept the 2-year, 24-hour **runoff** volume from the **tributary area**.

In all cases, it is important to consider measures that capture and contain **sediment** close to its source. **Sediment control practices** should always be integrated with **erosion control practices**, and should never be used as stand-alone methods of water quality protection.

Sediment control can be accomplished using the following general control mechanisms:

- Perimeter Controls: Vegetated buffers, **silt fences**, rolled barriers;
- Inlet Controls: Inlet filter bags, above grade inlet filters;
- Entrance/Exit Controls: **Stabilized** construction entrance/exit, tire wash stations;
- **Sedimentation** Controls: **Sediment** traps, **sediment basins**, flocculents;
- Instream **Sediment** Controls: Turbidity curtains, cofferdams; and/or
- Dewatering Operation Controls: Rim ditching, sock pipe/horizontal wells, well point systems, tank systems, and filtration.

Perimeter Controls

Perimeter controls are methods of containing **sediment** within the boundaries of the project **site**, or preventing offsite sources of **sediment** to enter the **site**. These practices prevent the discharge of **sediment** by filtering and dissipating the energy of **sediment** laden sheet flow **runoff**. All **site** characteristics should be considered when selecting appropriate perimeter control practices. Perimeter controls must be installed and functioning prior to soil disturbance (§402.3).

Inlet Controls

Inlet controls prevent the movement of **sediment** and other pollutants into the **storm sewer** network. All **site** and **storm sewer** characteristics should be considered when selecting an appropriate inlet control. Sheet flow draining to drop inlets may require different methods of treatment than shallow concentrated flow draining to culvert inlets, so it is important to select an inlet control best suited to accommodate the expected velocity, shear stress, and **sediment** load of **site runoff**.

Entrance/Exit Controls

Entrance/Exit controls prevent offsite tracking of **sediment** at all points of construction ingress/egress where **sediment** can be tracked onto public roads. Any soil reaching a public or private roadway shall be removed immediately and transported to a controlled **sediment** disposal area.

Sedimentation Controls

Sedimentation controls utilize excavated or impounded areas to temporarily detain **sediment**-laden water to promote settling of suspended particles prior to discharge. The outlets of **sedimentation** controls should be **stabilized** (see Velocity Dissipation Measures) such that treated water does not become re-contaminated. Designs should allow for adequate retention time to ensure maximal **sedimentation** for the anticipated **sediment** loads. Pumping **sediment**-laden water into any **stormwater facility** that is not designated to be a **sediment** control measure, **sediment** trap, or **sediment basin** either directly or indirectly without filtration is prohibited.

Sediment traps should only be used for small disturbed soil areas draining less than one acre, and for treating coarse textured soils consisting of medium to large sized **sediment** particles (sands and coarse silts). If the contributing **drainage area** is greater than one acre, or **site** consists of finer textured soils, such as silts and clays, a **sediment basin** should be used. Basins are appropriate for large disturbed soil areas draining between one and ten acres, but are not appropriate for **drainage areas** greater than 75 acres.

Design of **sediment** traps and basins should provide enough storage to accommodate the settling process (live storage) in addition to the accumulated **sediment** (dead storage). Live storage volume should, at a minimum, accommodate the 2-year, 24-hour **runoff** volume for the **tributary area** to each **sediment** trap or basin. Dead storage should be sized to store the estimated **sediment** load generated from the **site** over the duration of the construction period and be below the permeable fill. The **sediment** load can be estimated by using the Revised Universal Soil Loss Equation (RUSLE). Total storage may consist of only live detention storage; however, a more frequent schedule for **sediment** removal will be required. The following example demonstrates how to calculate the 2-year, 24-hour **runoff** volume for an example **site**.

<u>Example 4.1: Sediment Basin Sizing</u>

This example demonstrates how to size a **sediment basin** for a 10-acre **site**. The WMO requires that the **sediment basin** be sized based on the 2-year, 24-hour **runoff** volume from the tributary **drainage area**. In this example, it is assumed that the entire project **site** (10 acres) is tributary to the **sediment basin**.

To calculate the **runoff** volume, the **NRCS runoff** equation is used, which is:

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

where,

R = **runoff** depth (in)
P = 2-year, 24-hour rainfall depth of 3.04 in (**Bulletin 70** Northeast Section)
S = potential maximum retention after **runoff** begins (in), and is calculated by:

$$S = \frac{1000}{CN} - 10$$

where,

CN = **runoff** curve number for the **tributary area**. A CN of 91 is used, assuming newly graded (bare soil) and C soils.

$$S = \frac{1000}{CN} - 10 = \frac{1000}{91} - 10 = 0.99 \text{ in}$$

Substituting the known values for P and S,

$$R = \frac{(3.04 - 0.2*0.99)^2}{(3.04 + 0.8*0.99)} = 2.11 \text{ in}$$

The volume of **runoff** (acre-feet), V, from the **tributary area**, A, can then be calculated by:

$$V = \frac{R}{12} \text{ x Area } = \frac{2.11 \text{ in}}{12 \text{ in/ft}} \text{ X 10 ac } = 1.76 \text{ ac-ft}$$

Therefore, the required **sediment basin** volume is 1.76 acre-feet.

Instream Sediment Controls

These are methods of **sediment** containment when work must occur in or near **waterways**. Instream **sediment** controls are implemented to contain and prevent **sediment** loading of surface waters and subsequently protect **watershed** quality. All necessary permits (USACE, **FEMA**, **IEPA**, Section 401 and Section 404 permits, etc.) must be granted before installation can begin. Examples of instream **sediment** controls include turbidity curtains and cofferdams.

Dewatering Operation Controls

Dewatering operations remove and treat **groundwater** from an excavation area. These controls ensure safe working conditions, proper removal of contaminants, and appropriate discharge of **groundwater**. Dewatering operations include Filtration Systems, Pipe Socks, Horizontal Wells, Well Point Systems, and Dewatering Tanks. Construction dewatering operations shall be designed and operated so that water discharged from a **site** will meet State of Illinois water quality standards, as set forth in Title 35, Subtitle C, Chapter I, Part 302, Subpart B, Illinois Administrative Code.

Table 4-2. *Illinois Urban Manual* Drawings for Temporary Sediment Control Strategies

Temporary Sediment Control Measure	*Illinois Urban Manual* Code
Perimeter Controls	
Silt Fence	920
Filter Strip	835
Permanent Vegetation	880
Sodding	925
Temporary Seeding	965
Tree and Forest Ecosystem Preservation	984
Inlet Controls	
Culvert Inlet Protection	808
Inlet Protection - Fabric Drop	860
Inlet Protection - Excavated Drain Plan	555
Inlet Protection - Paved Areas Curb Protection	561C
Inlet Protection - Paved Areas Drop-In Protection	561D
Inlet Protection - Fabric Drop Plan	560
Inlet Protection - Sod Filter Plan	562
Sedimentation Controls	
Rock Check Dam - Riprap	605R
Rock Check Dam	905
Temporary Sediment Trap	660
Sediment Basin Dewatering Device	615
Polyacrylamide for Temporary Soil Stabilization	893
Polyacrylamide for Turbidity Reduction and Sediment Control	894
Sedimentation Controls	
Ditch Check (Manufactured)	514PC,514RC,514SC,514UF, 514VC
Instream Controls	
Floating Silt Curtain Cofferdam	617A, 617B, 917 803
Dewatering Operation Controls	
Dewatering	813
Portable Sediment Tank	895
Sump Pit	950

CONSTRUCTION SITE MANAGEMENT REQUIREMENTS (§403)

Construction **site** management practices are considered "good housekeeping" measures that are to be carried out throughout the duration of the project. These practices aim to reduce or eliminate the spread of pollutants by placing structural and/or procedural controls on activities that have the potential to pollute **stormwater runoff**. Emphasis is placed on preventing contact of **stormwater** with sources of pollutants. **Stabilized** construction entrances, proper management of soil stockpiles, and the proper installation of temporary stream crossings are all examples of construction **site** management controls. Good housekeeping can be accomplished using the following general control mechanisms:

- Material Handling and Waste Management: proper delivery, storage, and removal of construction materials and wastes;
- Spill Prevention and Control: **development** of a spill prevention and control plan;
- Equipment and Vehicle Use: designated fueling, cleaning, and **maintenance** areas;
- Street Sweeping and Vacuuming: timely removal of **sediment** tracked onto roadways;
- Allowable Non-**Stormwater** Discharge Management: prevention of contamination of these discharges from **stormwater**; and
- Stockpile Management: BMP implementation and proper location of piles.

One of the most useful tools for efficient construction **site** management is adequate signage. Legible signs should be placed throughout the construction **site** to identify vehicle wash and **maintenance** stations; designate solid, liquid, and hazardous waste storage locations; and convey any important notices concerning construction **site** management practices.

Temporary Stream Crossings

A temporary stream crossing is a culvert, ford, or bridge placed across a **waterway**, when frequent crossing cannot be avoided. Crossings are designed for short-term use (one year or less), allowing construction vehicles and heavy equipment to cross **waterways** while avoiding downstream **sedimentation** or damage to the channel morphology and ecosystem. All necessary permits (**Corps**, **FEMA**, **IEPA**, Section 401 and Section 404 permits, etc.) must be granted before installation can begin.

Temporary stream crossings should not cause **erosion** or damage due to increases in water surface profiles to adjacent properties. Disturbance or removal of vegetation should be limited to that which is necessary to complete construction, and when necessary, vegetation should be cut off no lower than ground level to promote re-growth. Riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to underlying soil and root **structure**.

Temporary stream crossings used during construction should be designed to convey a two-year, 24-hour **flood** event without overtopping unless the **District** approves a more frequent design event. In addition, the following conditions should be met:

- Temporary stream crossings should not reduce the carrying capacity of the channel;
- The entire crossing should be designed to withstand hydrodynamic, hydrostatic, and erosive forces up to the **base flood** event without washing out;
- Upon completion the temporary stream crossings should be entirely removed and the stream bed and banks restored to a stable non-erosive condition that incorporates native vegetation where appropriate; and
- **Erosion and sediment control practices** should be implemented and maintained during installation, **maintenance**, and removal of temporary stream crossings.

All **structures** should be inspected often, especially following **runoff**-producing rainfall, for any blockages in the channel and for **sediment** or debris buildup upstream or within the stream crossing **structure**.

A listing of ***Illinois Urban Manual*** Drawings for recommended construction **site** management controls is provided in Table 4-3.

Table 4-3. *Illinois Urban Manual* Drawings for Construction Site Management Strategies

Construction Site Management Strategy	*Illinois Urban Manual* Code
Stabilized Construction Entrance	930
Temporary Stream Crossing	975
Temporary Concrete Washout Facility	954

PERMANENT EROSION CONTROL REQUIREMENTS (§404)

Permanent **stabilization** means that all soil disturbing activities in an area of the **site** have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover has been established on all unpaved areas and areas not covered by permanent **structures**. Vegetative cover must have a density of 70 percent of the native background vegetative cover. A **disturbed area** may also be considered permanently **stabilized** if riprap, gabions, or other non-vegetative practices are installed.

In general, permanent **stabilization** using seeding often takes time (weeks or even months), especially during times of low rainfall or during the colder months of the year, so it is important to generate an appropriate timeline for permanent **stabilization** in order to prevent extended and costly **maintenance** of temporary **erosion and sediment control practices**.

Permanent **stabilization** must be initiated within seven days following the completion of soil disturbing activities. All temporary **erosion and sediment control practices** should be maintained until permanent **stabilization** is achieved and then removed within 30 days of **stabilization**.

By bringing areas of the **site** to permanent **stabilization**, the workload associated with maintaining and inspecting temporary **erosion and sediment control practices** will be reduced as routine inspections can be discontinued in that area. Table 4-4 provides the ***Illinois Urban Manual*** standard drawings for permanent vegetation.

Table 4-4. *Illinois Urban Manual* Drawings for Permanent Erosion Control Strategies

Permanent Erosion Control Strategy	*Illinois Urban Manual* Code
Permanent Vegetation	880, 880a, 880b, 880c, and 880d

TYPICAL EROSION AND SEDIMENT CONTROLS BY DEVELOPMENT TYPE

The acceptable **erosion and sediment control practices** will vary from project to project, however, certain types of projects will have many of the same practices in common. Examples of typical **erosion and sediment control practices** for different types of **development** are shown in Table 4-5 below.

Table 4-5. Typical Erosion and Sediment Control Practices by Development Type

Development Type	Typical Erosion and Sediment Control Practices
Commercial	• Stabilized Construction Entrance • Silt Fence • Seeding with Erosion Control Blanket • Sedimentation Basin • Concrete Washout Facility • Inlet Protection
Underground Utility Project (within FPA)	• Stabilized Construction Entrance • Double-row silt fence to protect FPA • Placement of soil stockpiles outside of FPA
Single-Family Development (within FPA)	• Stabilized Construction Entrance • Double-row silt fence to protect FPA • Inlet Protection • Sodding and/or Seeding with Erosion Control Blanket • Placement of soil stockpiles outside of FPA
Roadway/Alleyway Projects	• Stabilized Construction Entrance • Silt Fence • Concrete Washout Facility • Inlet Protection

It should be noted that the **erosion and sediment** controls shown in Table 4-5 are typical practices for those **development** types. These should be considered the minimum **erosion and sediment practices** that are required, and depending on the project, additional measures may be required to meet the requirements of Article 4 of the WMO.

SEDIMENT CONTROL PRACTICES FOR GREEN INFRASTRUCTURE

Because every **development** permitted under the WMO is required to incorporate **green infrastructure** into the **site** design, special **maintenance** practices should be developed (both during construction and post-construction) that ensure that the **green infrastructure** functions properly over time. Without proper **maintenance**, the void spaces in porous pavement and infiltration basins may become clogged with **sediment**, reducing their effectiveness.

During Construction

Green infrastructure is susceptible to failure during construction and therefore it is important that staging, construction practices, and **erosion and sediment control practices** all be considered during their installation. To protect the long-term functionality of volume control practices, the following measures should be addressed in the construction sequencing, general notes, and/or **soil erosion and sediment control** plan for a **development**:

- **Volume control practices** should be installed toward the end of the construction period.
- The contributing **drainage area** must be stabilized prior to the installation of the **volume control practice**.
- Soil compaction shall be minimized as much as possible during **site** grading. Appropriate measures (such as fencing) should be used to prevent heavy construction equipment traffic from accessing the area.
- **Volume control facilities** must be protected with a double-row of silt fence (or equivalent measure) during construction. The two layers of silt fence should be placed at least 5 feet apart and must follow the ***Illinois Urban Manual*** standards.
- In general, **volume control facilities** should not be used as temporary sediment traps during construction. For **sites** where this is not practicable, special construction notes and/or details are required to protect the functionality of the facility.

Post-Construction

To prevent clogging in the void space of pervious pavement (concrete, asphalt, pavers), it is recommended that adjacent landscaped areas be designed such that **stormwater runoff** from these areas onto the porous pavement is minimized. In addition, low pressure power washing and vacuuming of the surface is recommended on a yearly basis. This **maintenance** is especially critical during the fall. High pressure washing should be avoided for these types of surfaces, as it can cause damage to the pavement. Proper **maintenance** is especially difficult for pervious pavers, because extra care must be taken so that power washing and vacuuming does not dislodge the small chips that are used to fill in the paver gaps. In addition, small debris can collect in the paver gaps and lead to weed growth.

For infiltration trenches and basins, the use of a mulch layer above the infiltration practice will work like a filter for the **sediment** transported by **stormwater runoff**. The mulch layer will need to be replaced when it is filled, but will protect the void spaces in the soil and aggregate layers below from **sedimentation**. An alternative to using a mulch layer is the installation of a **sediment** trap upstream of the infiltration area. The **sediment** trap is a small depression that captures **stormwater** and allows the **sediment** to settle before it reaches the infiltration basin. For the **sediment** trap to be effective, the collected **sediment** must be removed regularly.

REFERENCES

EnviroCert International, Inc. 2010. Certified Professional in Erosion and Sediment Control Exam Review Study Guide.

Illinois Environmental Protection Agency.2013.General NPDES Permit No. ILR10. Available at: http://www.epa.state.il.us/water/permits/storm-water/general-construction-permit.pdf

Kane County Technical Reference Manual. Available at: http://www.countyofkane.org/FDER/Documents/waterOrdinances/technicalManual.pdf

Lake County Technical Reference Manual. Available at: http://www.lakecountyil.gov/Stormwater/FloodplainStormwaterRegulations/WDOandTRM/Pages/TechnicalReferenceManual.aspx

Lutey, Brian, email interview by Megan Elberts. *Porous Concrete Design and Considerations* (Nov. 15, 2011).

Minnesota Pollution Control Agency. Construction Specifications for Permeable Pavement. Available at: http://stormwater.pca.state.mn.us/index.php/Construction_specifications_for_permeable_pavement

US Department of Agriculture Natural Resources Conservation Service. 2012. Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/il/technical/

US Environmental Protection Agency. 2007. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites. Available at: http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

ARTICLE 5: REQUIREMENTS FOR STORMWATER MANAGEMENT

Introduction

Site stormwater management involves the control of **stormwater runoff** from **development sites** to minimize the potential for adverse impacts on adjacent and downstream properties. The goal of **site stormwater** management, as stated in §501.1 of the WMO, is to ensure that **development** does not:

- "Increase **flood** elevations or decrease **flood** conveyance capacity upstream or downstream of the area under the **ownership** or control of the **co-permittee**;
- Pose any increase in **flood** velocity or impairment of the hydrologic and hydraulic functions of streams and **floodplains** unless a **water resource benefit** is realized;
- Violate any provision of this **ordinance** either during or after construction; and
- Unreasonably or unnecessarily degrade surface or **groundwater** quality."

The objective of **stormwater** management is to balance **development** with **stormwater** drainage and design approaches that do not cause an increase in **flooding** and do not unreasonably or unnecessarily degrade water quality due to **development**. **Site development** and **stormwater** management standards are established in the WMO to meet the requirements of §501.1. **Site stormwater** management involves the control of the rate, volume, and quality of **stormwater runoff** associated with **development**. The WMO requires several practices to be incorporated into the **site** drainage design to address these impacts, including **detention** (rate control), **volume control practices** (volume reduction), and **flow-through** (treatment) requirements.

The WMO provides standards for **stormwater** management including:

- **Site Runoff** Requirements (§502);
- **Site Volume Control** Requirements (§503);
- **Site Detention** Requirements (§504); and
- Allowances for **Redevelopment** (§505).

The purpose of this section of the **TGM** is to provide guidance on how to demonstrate compliance with the WMO requirements, in order to ensure that the **development** or **redevelopment** will not result in a negative impact to downstream or adjacent properties.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

GENERAL SITE DEVELOPMENT AND STORMWATER MANAGEMENT REQUIREMENTS (§501)

Site Stormwater Management and Development Categories

The WMO regulates **developments** based on the size and type of **development**. Table 5-1 (Table 2 in the WMO) summarizes which **site stormwater** management requirements must be met, depending on the size of **parcel** and type of **development**.

There are three categories of **site stormwater** regulations:

1. **Site Runoff** Requirements (§502);
2. **Site Volume Control** Requirements (§503); and
3. **Site Detention** Requirements (§504).

There are five types of **developments** specifically covered in the WMO:

1. **Single-family home**;
2. **Residential subdivision**;
3. **Non-residential** and multi-family **development**;
4. **Right-of-way development**; and
5. **Open space** (not part of a larger **development**).

Table 5-1 shows the **stormwater** regulation categories for the different classifications of **developments**. As defined in the WMO, **parcel** or **parcels** means "**contiguous** land area under single **ownership** or control, under an affidavit of **ownership**, or under a single legal description on record with the **Cook County** Recorder of Deeds Office." As defined in the WMO, **development** means:

"Any human-induced activity or change to real estate (including, but not limited to, grading, paving, excavation, dredging, fill, or mining; alteration, subdivision, change in land use or practice; **building**; or storage of equipment or materials) undertaken by private or public entities that affects the volume, flow rate, drainage pattern or composition of **stormwater**, or the **substantial improvement** of an existing **building** in a **Special Flood Hazard Area**. The term **development** shall include **redevelopment** and shall be understood to not include **maintenance**."

Table 5-1. Summary of Site Stormwater Management Requirements (Table 2 from WMO)[1]

Development Type (See Appendix A of the WMO for definitions.)	**§502** Runoff Requirements	**§503** Volume Control Requirements[2]	**§504** Storage Requirements[2]
Single-Family Home	Exempt	Exempt	Exempt
Residential Subdivision	Parcels ≥ 1 acre	Parcels ≥ 1 acre	Parcels ≥ 5 acres
Multi-Family Residential	Parcels ≥ 0.5 acre	Parcels ≥ 0.5 acre	Parcels ≥ 3 acres ‡
Non-Residential	Parcels ≥ 0.5 acre	Parcels ≥ 0.5 acre	Parcels ≥ 3 acres ‡
Right-of-Way	New Impervious Area ≥ 1 acre	New Impervious Area ≥ 1 acre †	New Impervious Area ≥ 1 acre †
Open Space	Parcels ≥ 0.5 acre	Not Applicable	Not Applicable

1 **Site stormwater** management requirements are not required for **maintenance activities** as defined in Appendix A of the WMO.
2 Requirements are applicable when a **Watershed Management Permit** is required under §201 of the WMO.
‡ Starting the effective date of the WMO, any new **development** on the **parcel** that totals either individually or in the aggregate to more than one-half (0.5) of an acre.
† Where practicable.

At the bottom of Table 5-1, it is important to note that **site stormwater** management requirements are not required for **maintenance**. The examples of **maintenance** are provided to explicitly state that in-kind replacement or repair of existing infrastructure or facilities are not regulated under the WMO.

"Where practicable" is included with **right-of-way** (roadway) **development** since it is understood that often roadway design is limited by public **right-of-way** constraints. In cases where the WMO **stormwater** requirements have not been met, the applicant must demonstrate how the **development** has met the **stormwater** requirements of the WMO to the maximum extent practicable.

Developments less than or equal to 0.1 acre that require a **Watershed Management Permit** are exempt from the runoff (§502), volume control (§503), and Legacy Sewer Permit requirements (§505). **Developments** greater than 0.1 acre are subject to these requirements when the ownership area exceeds the thresholds specified in Table 5-1.

SITE RUNOFF REQUIREMENTS (§502)

As described in Table 5-1, the **site runoff** requirements in §502 apply to:

1. **Residential subdivision development** on **parcels** that total one acre or more; and/or
2. **Non-residential** or **multi-family residential development** on **parcels** that total 0.5 acre or more; and/or
3. **Right-of-way development** that creates one acre or more of **new impervious area**, and/or
4. **Open space development** on **parcel**(s) that total 0.5 acre or more.

Site runoff requirements are not required for the **development** of **single family homes** on individual residential lots. The act of subdividing land distinguishes between a **single family home** and a **residential subdivision**, which is subject to the **site stormwater** requirements in Article 5. **Site runoff** requirements (§502) for **development** may include the:

1. Determination of **watershed** boundaries;
2. Design of minor **stormwater facilities**;
3. Design of major **stormwater facilities**;
4. Determination of **design runoff rate**s;
5. Consideration of existing sub-surface drainage;
6. Consideration of **upstream tributary flows** and bypass flows;
7. Protection of **depressional storage**;
8. Allowable flow depths on roadways and parking lots; and/or
9. **Building** protection standards.

Not all **development sites** will contain all of the **site** features discussed in §502. In addition, the applicant must procure all federal, state, and/or local permits associated with the **stormwater runoff** from the **site**.

Transfer Between Watersheds

Unless there are extenuating circumstances for a **development**, **stormwater runoff** should stay within the existing **watershed**. The WMO (§502.2) specifies that the transfer of water between **watersheds** is prohibited unless such transfers do not violate the provisions of §501.1 of the WMO. "**Watershed**" for this provision is defined as the **tributary area** to the **waterway** to which the **development** drains. "Transfer" refers to the diversion of **runoff** or stream flow via overland flow paths or **storm sewer** systems.

In order to demonstrate compliance with §502.2, the existing and proposed conditions **tributary areas** must be evaluated for the **site**. For the determination of the **development site's watershed** boundaries, topography from **Cook County** or the US Geological Survey (USGS) should be obtained. Some **sites**, prior to **development**, may contain a ridge line resulting in the **site** being tributary to multiple **watersheds**. The proposed grading plan for the **site** should preserve these natural drainage boundaries. For any portions of the **site** that drain to another **watershed**, it must be demonstrated that no negative impacts will result to any **watershed** to which the **site** was originally tributary. Negative impacts include increases in flowrates, velocities, and **flood** elevations. The maximum permissible impact is a 0.1-ft increase in **flood** elevations and a 10% increase in velocities. Computation of flows must be completed utilizing the methodology required for **major stormwater systems**.

Minor Stormwater Systems

Minor stormwater systems are typically designed to collect and convey events less than the 100-year **storm event** and consist of **storm sewers**, inlets/catch basins and other **stormwater** collection appurtenances. **Minor stormwater systems** prevent water from ponding on roadways, sidewalks, and properties during the more frequent **storm events**.

§502.5 requires that the **minor stormwater systems** be sized to convey **runoff** from the **tributary area** under fully developed conditions consistent with the design requirements of the local jurisdiction or existing **stormwater** system. Minor **stormwater facilities**, when not regulated by the local community, should be designed to convey a minimum of the 10-year event by gravity, with no pressure flow in the conduits.

Minor **stormwater facilities** should consider all **watershed** areas upstream of the point of design under fully developed conditions to ensure that they are not undersized. In some cases, the fully developed conditions of the upstream area may be the current land. Regardless, the upstream land use conditions must be assessed. In cases where the upstream **tributary areas** are still subject to **development**, the municipal or County land use plans should be evaluated. If the upstream **tributary area** is subject to further **development**, then any special considerations of the **runoff** rate must be pre-approved by the **District** or an **authorized municipality**.

Rational Method

The Rational Method can be utilized to determine the peak flow from a particular **tributary area** for the sizing of minor **stormwater facilities**, primarily consisting of inlets and **storm sewers**. The Rational Method is defined as:

$$Q = C \cdot i \cdot A$$

Where: Q = peak rate of flow (cubic feet/second)

C = Composite **runoff** coefficient , based on Table 5-2

i = intensity of precipitation (inches/hour)for a duration equal to time of concentration, t_c, and a given return period (Table 5-3)

A = area (acres)

For each **drainage area**, the composite **runoff** coefficient (C) must be computed using the values shown in Table 5-2.

Table 5-2. Runoff Coefficients (C Values) for the Rational Method

Surface Type	Runoff Coefficient, C
Impervious area (Roads, roofs, sidewalks, etc.)	0.90
Pervious Area	0.45
Gravel (loose, unbound)	0.75
Water Surface (open water)	1.00
Native Plantings	0.15
Wetlands	0.79
Synthetic Turf Fields	0.75
Green Infrastructure:	
Pervious Surfaces (Porous Asphalt, Pervious Concrete, Permeable Pavers)	0.75
Bioswale	0.10
Rain Garden	0.10
Green Roof	(Refer to Table 5-9)

The duration used for the rainfall intensity, i, is equal to the time of concentration, t_c, for the **drainage area**. An example t_c calculation is provided in Example 5.3. **Bulletin 70** sectional rainfall intensities are to be used for Rational Method calculations; these rainfall intensities are provided in Table 5-3 below. The rainfall intensities provided in Table 5-3 can be used to generate intensity-frequency-duration (IDF) curves for **storm sewer** sizing applications. For example, Figure 5.1 shows the IDF curves generated by the *Hydraflow* computer software based on the user-specified **Bulletin 70** rainfall intensities.

Table 5-3. *Bulletin 70* Northeast Sectional Rainfall Intensities

Duration	Intensity (in/hr)						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5 min	3.60	4.32	5.52	6.48	7.92	9.36	10.92
10 min	3.30	4.02	5.04	5.88	7.26	8.52	10.02
15 min	2.72	3.28	4.12	4.84	5.96	7.00	8.20
30 min	1.86	2.24	2.82	3.30	4.08	4.78	5.60
1 hour	1.18	1.43	1.79	2.10	2.59	3.04	3.56
2 hour	0.74	0.90	1.12	1.32	1.63	1.91	2.24
3 hour	0.53	0.65	0.81	0.95	1.18	1.38	1.62
6 hour	0.31	0.38	0.48	0.56	0.69	0.81	0.95

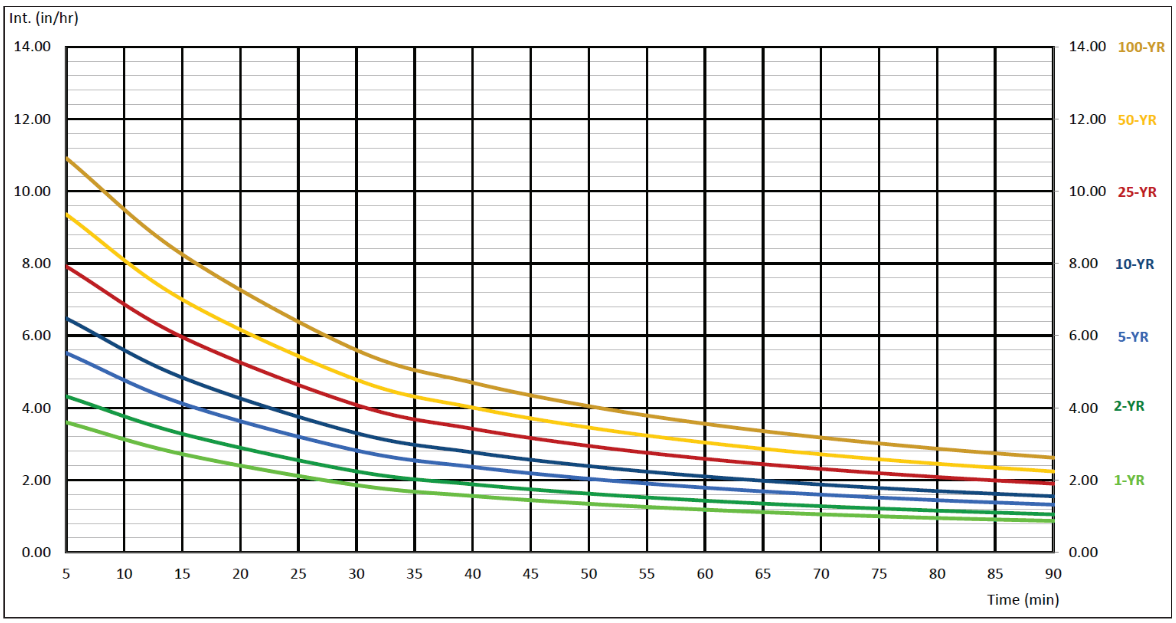


Figure 5.1. *Bulletin 70* Northeast Sectional IDF Curves (Generated by *Hydraflow*)

Once the peak flowrate has been established, Manning's equation can be used to size the pipe or open channel through an iterative process. This must be done until design capacity from Manning's equation is found to exceed the required peak flow design rate as determined in the Rational Method. Manning's equation is as follows:

$$Q = \frac{1.49}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

Where: Q = design flowrate (cubic feet/second)

n = the roughness coefficient of the pipe or channel (dimensionless)

A = the cross sectional area of the pipe or channel (square feet)

R = the hydraulic radius of the pipe or channel which is the area (square feet) divided by the wetted perimeter (feet)

S = the slope of the pipe or channel (foot/foot)

Example 5.1 – Sizing of a Minor Stormwater System

For the proposed drainage schematic shown below, determine the required **storm sewer** sizes to convey the 10-year **storm event**. The area, **runoff** coefficient, and time of concentration are provided for each subbasin. Also provided are the rim elevations of each proposed **structure** and the distances between **structures**. Use Manning's equation to determine the required pipe sizes for the proposed drainage system.

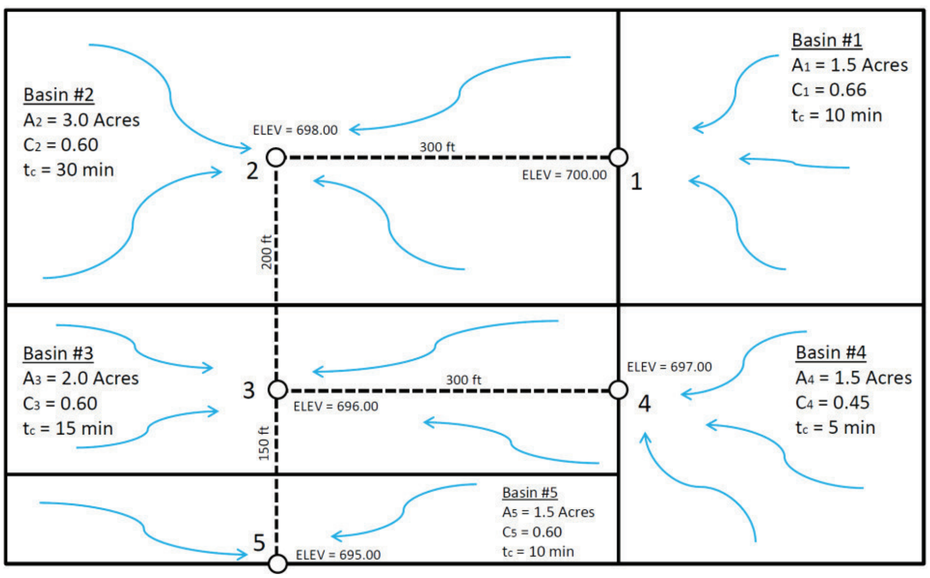


Figure 5.2. Proposed Drainage Schematic for Storm Sewer Sizing

In this example, a spreadsheet based on Manning's equation is used to size the **proposed storm sewers**. The completed spreadsheet with the required **storm sewer** sizes is provided as Figure 5.3. Referring to Figure 5.3, the following items should be noted:

- Rainfall intensities are calculated from the IDF curves provided as Figure 5.1 and are based on **Bulletin 70** northeast sectional rainfall depths.
- Manning's equation is used to verify the full-pipe capacity is greater than the design 10-year peak flowrate.

- A Manning's equation spreadsheet is an acceptable alternative to a **storm sewer** sizing computer program such as *Hydraflow*, *HYDRA*, and *StormCAD*. If an applicant is using computer software to design a **storm sewer** network, the hydraulic grade line (HGL) of the system must be plotted to ensure the **storm sewer** system is not under pressure flow for the 10-year design. Because Manning's equation assumes full-pipe conditions, the HGL is equal to the crown of the pipe and therefore no other HGL calculations are required using this methodology.

Project: Cook County TGM   Date: 1/13/2014   Sheet 1 of 1

Engineer: LJS   Design Storm = 10 Years   Manning's n = 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (ft)	C_j	Aj (Acres)	C_j*A_j	Sum C_j*A_j	t_j (min)	t_{cum} (min)	I (in/hr)	Q (cfs)	Pipe Diameter (in)	Pipe Slope (%)	Pipe Capacity (cfs)	Velocity (ft/s)	Travel Time (min)	Rim Elevation Upstream (ft)	Rim Elevation Downstream (ft)	Invert Elevation Upstream (ft)	Invert Elevation Downstream (ft)	Pipe Cover Upstream (ft)	Pipe Cover Downstream (ft)
1	1	2	300	0.66	1.50	0.99	0.99	10.0	10.0	5.88	5.82	15	0.83	5.89	4.80	1.04	700.00	698.00	695.00	692.50	3.38	3.88
2	2	3	200	0.60	3.00	1.8	2.79	30.0	30.0	3.30	9.21	21	0.75	13.72	5.70	0.58	698.00	696.00	692.50	691.00	3.58	3.08
3	4	3	300	0.45	1.50	0.68	0.68	5.0	5.0	5.52	3.73	15	0.33	3.73	3.04	1.65	697.00	696.00	692.00	691.00	3.38	3.38
4	3	5	150	0.60	2.00	1.2	4.67	15.0	30.6	3.26	15.21	24	0.67	18.48	5.88	0.43	696.00	695.00	691.00	690.00	3.08	3.08
5	5	out	---	0.60	1.50	0.9	5.57	10.0	31.0	3.24	18.03	---	---	---	---	---	695.00	---	690.00	---	3.08	---

Figure 5.3. Storm Sewer Design Sheet – Rational Method, Example 5.1

Major Stormwater Systems

Major stormwater systems are drainageways that convey flows from major storms when the capacity of **minor stormwater systems** is exceeded. Generally, the **minor stormwater system** is designed to carry the 10-year design **runoff** event and the **major stormwater system** is designed to carry the additional flow for the 100-year design **runoff** event. The WMO (§502.6) requires that the **major stormwater system** be designed to convey the **design runoff rate** of the 100-year **storm event** using a **critical duration analysis** and an event hydrograph method. A **critical duration analysis** is required only for the following:

1. Large **developments**, where:
    a. Residential > 10 acres, and
    b. Commercial > 5 acres
2. Smaller sites with an offsite flow area greater than the **development** area; and
3. Clear conveyance issues that may contribute to onsite flooding.

The **design runoff rate** for **major stormwater systems** must include the calculated flows from all the **tributary areas** upstream of the point of design without increasing **flood** or **erosion** damages downstream or on adjacent properties. A **major stormwater system** consists of the overland flow routes and channels that convey **stormwater runoff** that exceeds the **storm sewer** capacity downstream, to the **site detention facility**.

In general, the **minor stormwater system** consists of a **storm sewer** system (designed for the 10-year return interval), and the **major stormwater system** consists of an overland flow path (designed for the 100-year return interval). Overland flow paths can consist of roadways or side/rear yard swales and can be sized using Manning's equation. As shown in Table 5-4 below, only two Manning's n values should be used for the design of the overland flow route, depending on whether the proposed channel is paved or unpaved.

Table 5-4. Manning's n Values for Design of Overland Flow Routes (Source: Chow, 1959)

Surface Type	Manning's n Value
Paved Channels (asphalt or concrete roadways)	0.013
Unpaved Channels (grassed)	0.035

For all projects, the direction of flow for **major stormwater systems** should be clearly shown on the appropriate plan sheets and exhibits (grading plan and drainage exhibit). Flow arrows should be provided that show the direction of overland flow, and if storm sewers are sized to convey the 100-year design runoff rate, this should be indicated on the utility plan.

Event Hydrograph Methods

The maximum flowrate determined in the 100-year **critical duration analysis** will establish the **design runoff rate**. As with the **minor stormwater system** design, the major **stormwater facilities** should consider all **watershed** areas upstream of the point of design under fully developed conditions to ensure that they are not undersized. Peak discharge for conveyance of **stormwater** and the design of **stormwater facilities** must be based on the **critical duration analysis** using the appropriate rainfall distribution. The analysis should include the 1-, 2-, 3-, 6-, 12-, 18-, 24- and 48-hour storm durations to determine the critical storm duration for the **watershed**.

The following event hydrograph methods are allowed for the determination of the **design runoff rate** and the sizing of **major stormwater facilities**:

1. HEC-1 (SCS **runoff** method);
2. HEC-HMS (SCS **runoff** method); and
3. TR-20.

Other modeling programs that are not listed may be used with the approval of the **District**. Event hydrographs must incorporate the following:

1. Antecedent Moisture Condition II. The antecedent moisture condition is the measure of the soil conditions with respect to **runoff** potential before a storm. "I" is dry, "II" is average and "III" represents saturated soils conditions; the CN values for all **development** should be based on the values provided in Table 5-7, which are based on an AMC II.
2. Huff Rainfall Distribution. The Huff rainfall distribution is a measure of the time distribution of rainfall for **storm events** of various durations. The appropriate Huff quartile distribution to be used for each associated rainfall duration is found in Table 5-5.

Table 5-5. Huff Quartile Distributions

HUFF QUARTILE DISTRIBUTIONS												
CUMUL. STORM PERCENT	AREA < 10 SM				AREA > 10 & AREA < 50				AREA > 50 & AREA < 400			
	HUFF QUARTILE				HUFF QUARTILE				HUFF QUARTILE			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
05	16	03	03	02	12	03	02	02	08	02	02	02
10	33	08	06	05	25	06	05	04	17	04	04	03
15	43	12	09	08	38	10	08	07	34	08	07	05
20	52	16	12	10	51	14	12	09	50	12	10	07
25	60	22	15	13	62	21	14	11	63	21	12	09
30	66	29	19	16	69	30	17	13	71	31	14	10
35	71	39	23	19	74	40	20	15	76	42	16	12
40	75	51	27	22	78	52	23	18	80	53	19	14
45	79	62	32	25	81	63	27	21	83	64	22	16
50	82	70	38	28	84	72	33	24	86	73	29	19
55	84	76	45	32	86	78	42	27	88	80	39	21
60	86	81	57	35	88	83	55	30	90	86	54	25
65	88	85	70	39	90	87	69	34	92	89	68	29
70	90	88	79	45	92	90	79	40	93	92	79	35
75	92	91	85	51	94	92	86	47	95	94	87	43
80	94	93	89	59	95	94	91	57	96	96	92	54
85	96	95	92	72	96	96	94	74	97	97	95	75
90	97	97	95	84	97	97	96	88	98	98	97	92
95	98	98	97	92	98	98	98	95	99	99	99	97

The distributions are expressed as percentages of cumulative rainfall depth as a percentage of storm duration. The 1st quartile distribution is applied to storm durations less than or equal to 6 hours, the 2nd quartile distribution is applied to storm durations greater than 6 hours but less than 12 hours, the 3rd quartile distribution applies to storm durations greater than 12 hours but less than or equal to 24 hours, and the 4th quartile distribution applies to storm durations greater than 24 hours. There are three separate Huff distributions that represent the three different sizes of **drainage areas** utilized in the study: **drainage areas** less than 10 square miles (left), **drainage areas** greater than 10 square miles but less than 50 square miles (center), and **drainage areas** between 50 and 400 square miles (right). The majority of projects will be using values for areas less than 10 square miles.

3. Illinois State Water Survey **Bulletin 70** Northeast Sectional Rainfall Statistics. **Bulletin 70** rainfall data provide the expected rainfall amounts for selected storm durations and return periods. Table 5-6 provides the **Bulletin 70** rainfall depths for the various storm durations and return intervals.

Table 5-6. Illinois State Water Survey Bulletin 70 Rainfall Depths for Northeast Sectional (inches)

Duration	Storm event Frequency						
	1-year	2-year	5-year	10-year	25-year	50-year	100-year
5 min	0.30	0.36	0.46	0.54	0.66	0.78	0.91
10 min	0.55	0.67	0.84	0.98	1.21	1.42	1.67
15 min	0.68	0.82	1.03	1.21	1.49	1.75	2.05
30 min	0.93	1.12	1.41	1.65	2.04	2.39	2.80
1 hour	1.18	1.43	1.79	2.10	2.59	3.04	3.56
2 hour	1.48	1.79	2.24	2.64	3.25	3.82	4.47
3 hour	1.60	1.94	2.43	2.86	3.53	4.14	4.85
6 hour	1.88	2.28	2.85	3.35	4.13	4.85	5.68
12 hour	2.18	2.64	3.31	3.89	4.79	5.62	6.59
18 hour	2.30	2.79	3.50	4.11	5.06	5.95	6.97
24 hour	2.51	3.04	3.80	4.47	5.51	6.46	7.58
48 hour	2.70	3.30	4.09	4.81	5.88	6.84	8.16
72 hour	2.93	3.55	4.44	5.18	6.32	7.41	8.78
120 hour	3.25	3.93	4.91	5.70	6.93	8.04	9.96
240 hour	4.12	4.95	6.04	6.89	8.18	9.38	11.14

Calculating Runoff Curve Number

The **runoff** curve number (CN) is a hydrologic parameter used to estimate the potential for **stormwater runoff** from a particular area. Factors affecting CN values include land cover type (including hydrologic conditions), hydrologic soil group, and antecedent moisture condition. The CN is used to calculate **runoff** volumes and flows for the **development site** as well as to size the **site's detention facility**. CN values must be calculated for both existing and proposed conditions of the **development site**.

For calculating CNs of proposed **developments**, the land uses and soil types should be taken from those listed in Table 5-7. This table is a modified version of Table 2-2a from the *Urban* ***Hydrology*** *for Small* ***Watersheds****, TR-55* (TR-55 Manual), published by **NRCS**, for determining curve numbers. The table also includes appropriate CNs for **volume control practices**. For further guidance, refer to the TR-55 Manual, which is available through the Certified Professional in **Erosion** and **Sediment** Control (CPESC) website at: http://www.cpesc.org/reference/tr55.pdf.

Table 5-7.Runoff Curve Numbers for Urban Areas

Cover Type and Hydrologic Conditions	Curve Numbers for Hydrologic Soil Group	
	C	D
Impervious area (roads, roofs, sidewalks, etc.)	98	98
Pervious area (open space, mostly grassed areas)	74	80
Gravel (railroad yards, roads, parking lots)	89	91
Water surface (open water)	100	100
Newly graded areas (pervious areas only, no vegetation)	91	94
Native Plantings	70	77
Wetlands	91	94
Synthetic Turf Fields	91	91
Green Infrastructure:		
Non-compacted gravel areas	91	91
Porous/permeable pavement	91	91
Bioswale	63	70
Rain Garden	63	70
Green Roof	Refer to Table 5-9	

The **development**s and **redevelopments** that will be permitted under the WMO will be mostly residential and commercial **developments** that have significant amounts of **impervious area**. Due to the general uniformity of **developments**, the land use types used in the CN calculation will be limited to those shown in Table 5-7. The majority of **Cook County** consists of either native poorly-drained soils (HSG C and D) or became that way due to **development**. The areas of the County that contain well-drained soils (HSG A and B) are extremely limited. And even though an area may be labeled as having well-drained soils on the soil survey, if the area has been developed, the soils have likely lost their infiltration capacity. Based on this information, the calculation of CNs for proposed **developments** should be based on HSG C and D type soils. The use of A and B soils in calculating CNs would only be allowed for those **sites** where native soils are currently intact and a soil test is performed to verify the infiltration capacity. The applicant would also have to demonstrate that these soils would be preserved under the developed conditions. Soils information for **Cook County** is available on-line through the **NRCS** at: websoilsurvey.nrcs.usda.gov/.

Example 5.2 provides a sample CN calculation for a 3-acre, **non-residential development** for proposed conditions, as shown in Figure 5.4. The CN calculation spreadsheet for this example is provided as Figure 5.5.

Example 5.2 – Example CN Calculation

Figure 5.4 shows a proposed **development** that consists of a **building**, a permeable pavement parking lot, **open space**, and a **stormwater** detention basin. Using **NRCS** TR-55 methodology, determine the CN for the **site**.

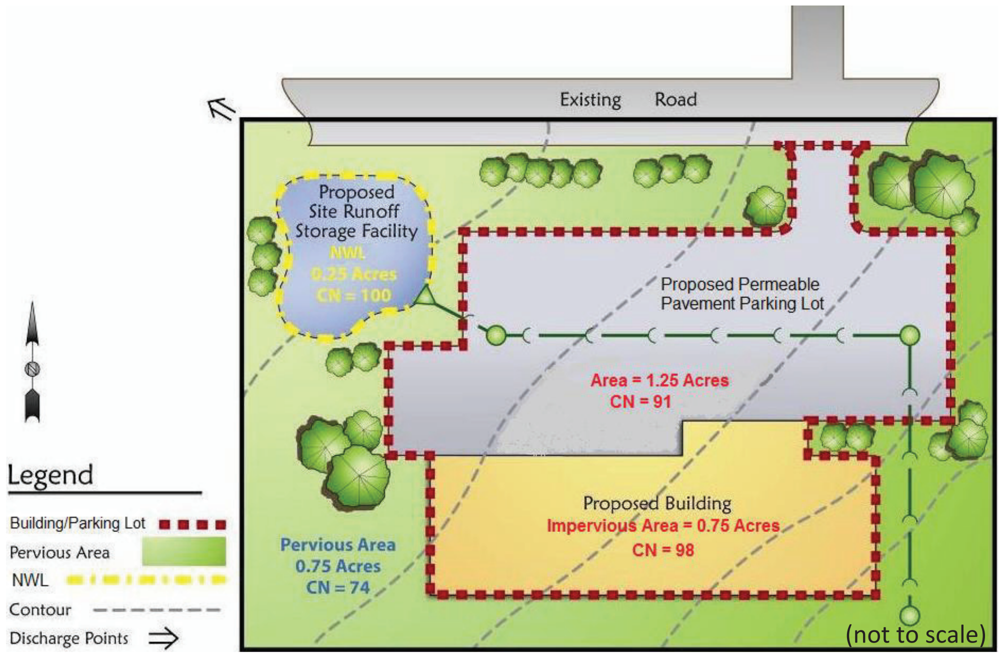


Figure 5.4. Example of Calculation of Runoff Curve Numbers

In this example, there are two types of pervious area onsite: (1) the **open space** around the perimeter of the **development** that is assumed to be in good condition (grass cover is >75%) and HSG C-type soils and (2) the permeable pavement parking lot. From the values provided in Table 5-7, the **open space** CN is 74 and the CN for permeable pavement is 91. A distinction is made between the two types of **impervious areas** on the proposed **site**: the **building** is assigned a CN of 98, while the open water of the wet-bottom detention basin (at the normal water level (NWL)) is assigned a CN of 100.

Using the CN worksheet, as shown in Figure 5.5, a composite CN of 89 is computed for the **development**.

Runoff Curve Number

Project: CN Example Calculation | By: LJS | Date: 12/22/2013
Location: Cook County, IL | Checked: JMG | Date: 12/23/2013
File: ExampleCN.xlsx

Circle One: Present **Developed** | Description: 3-Acre Site Example

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area [X] acres [ ] sq. mi. [ ] %	Product of Curve Number and Area
C	Pervious Area - Open Space, Good Condition	74	0.75	55.5
C	Permeable Pavement	91	1.25	113.75
	Impervious Area - Building	98	0.75	73.5
	Impervious Area - Open Water	100	0.25	25
		Totals =	3.00	267.75

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{267.75}{3} = $ 89.25

Use CN = **89**

Figure 5.5. CN Calculation Worksheet for Example 5.2

Calculating the Time of Concentration

The time of concentration (t_c) is the time it takes for **stormwater runoff** to travel from the most hydraulically distant point in a **watershed** to the **watershed** outlet. Based on the **NRCS** TR-55 methodology, the t_c for a **watershed** is a combination of sheet flow, shallow concentrated flow, and open channel flow.

Sheet flow is the first segment of a flow path and consists of shallow flow (less than 0.1 ft) over plane surfaces. Sheet flow should be limited to a length of 100 feet, and roughness coefficients (Manning's n values) for sheet flow over different types of surfaces should be taken from Table 5-8 (Table 3-1 from the **NRCS** TR-55 manual). To determine the travel time for sheet flow, Manning's kinematic (Overton and Meadows) solution should be used.

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

Where: T_t = travel time (hr)
n = Manning's roughness coefficient (Table 5-8)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall depth (3.04 in)
s = slope of hydraulic grade line (land slope, ft/ft)

Table 5-8. Manning's n Values for Sheet Flow (Table 3-1 from NRCS TR-55)

Surface Description	Manning's n Value
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils	
Residue Cover ≤ 20%	0.06
Residue Cover ≥ 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:	
Light underbrush	0.40
Dense underbrush	0.80

After 100 ft, sheet flow will transition to shallow concentrated flow. The travel time for shallow concentrated flow is based on the equation (TR-55 equation 3-1) shown below.

$$T_t = \frac{L}{3600V}$$

Where: T_t = travel time (hr)
L = flow length (ft)
V = average velocity (ft/s)
3600 = conversion factor from seconds to hours

The velocity term in the equation is calculated separately based on the type of surface. If the surface is "unpaved," the velocity is calculated using the following equation:

$$V_{unpav} = 16.1345(s)^{0.5}$$

Where: s = slope of the ground (ft/ft)

If the surface is "paved," the following equation should be used:

$$V_{pav} = 20.3282(s)^{0.5}$$

Water may also move through a **watershed** as open channel flow. Creeks, ditches, and **storm sewers** are all examples of open channel conveyance systems in a **watershed**. The travel time for open channel flow can be determined using TR-55 Equation 3-1, with flow velocities based on Manning's equation (assuming bankfull conditions). For open channel flow in **storm sewer**s, it is reasonable to assume an average velocity of 2 ft/s.

In general, urbanization decreases the t_c in **watersheds**, as flow over smooth, impervious surfaces – along with the installation of efficient conveyance systems such as **storm sewers** – speeds up the flows and decreases the t_c. The t_c affects the shape of the **runoff** hydrograph for a **watershed**: a shorter t_c results in a steep **runoff** hydrograph with a higher peak flow, whereas a longer t_c will flatten the shape of the **runoff** hydrograph and result in a lower peak flow. In many cases, particulary in small urban areas, the t_c will be small, and a minimum value of 10 minutes should be used.

Example 5.3 – Example Time of Concentration Calculation

The figure below shows the flow path from the most hydraulically distant point in a **watershed** (A) to the **watershed** outlet (D). Using **NRCS** TR-55 methodology, determine the time of concentration (t_c) for this **watershed** assuming the following:

Segment AB: Sheet flow; dense grass; slope = 0.03 ft/ft; length = 100 ft
Segment BC: Shallow concentrated flow; paved; slope = 0.02 ft/ft; length = 650 ft
Segment CD: Open channel flow; length = 900 ft; velocity = 2 ft/s (from Manning's equation)

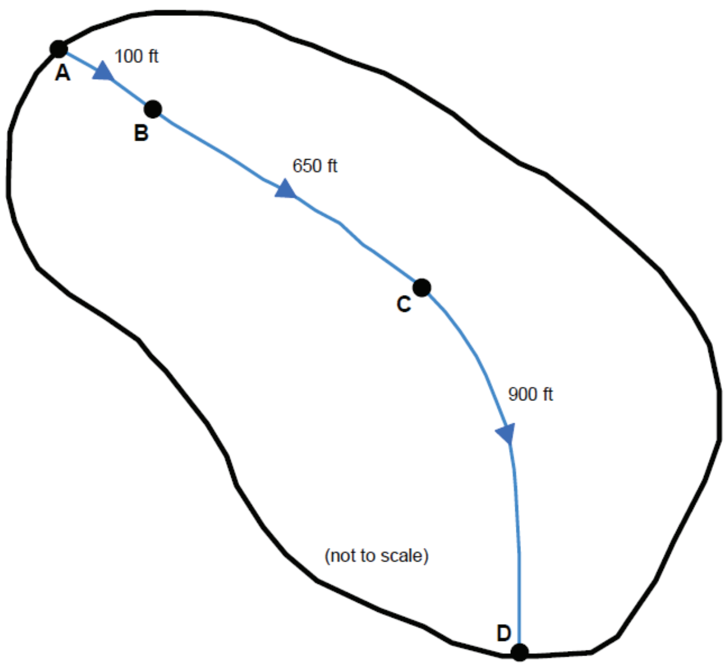


Figure 5.6. Time of Concentration Flow Path for Example 5.3

As shown in the calculation worksheet (Figure 5.7), the t_c for this **watershed** is 0.40 hours.

Time of Concentration (T_c) or Travel Time (T_t)

Project:	Example 5.2	By:	LJS	Date:	12/30/2013
Location:	Cook County, IL	Checked:	JSG	Date:	12/30/2013
File:	ExampleTC.xlsx				

Present / Developed

Tc through subarea — Example Watershed

SHEET FLOW

Segment ID		AB					
Surface Description (table 3-1)		Dense Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100')	(ft)	100					
Two-yr 24-hr rainfall, P2	(in)	3.04					
Land slope, s	(ft/ft)	0.03					
$T_t = (0.007(nL)^{0.8})/(P_2^{0.5}\ s^{0.4})$	(hr)	0.21	+		=	0.21	hr

SHALLOW CONCENTRATED FLOW

Segment ID		BC									
Surface Description (paved or unpaved)		pav.									
Flow Length, L	(ft)	650									
Watercourse slope, s	(ft/ft)	0.02									
Average velocity, V	(ft/s)	2.87									
$T_t = L / 3600\ V$	(hr)	0.06	+		+		+		=	0.06	hr

CHANNEL FLOW

Segment ID		CD					
Cross-sectional flow area, a	(ft^2)	10.1					
Wetted perimeter, Pw	(ft)	25.7					
Hydraulic radius, r = a/Pw	(ft)	0.39					
Channel slope, s	(ft/ft)	0.01					
Manning's roughness coeff., n		0.04					
$V = (1.49\ r^{0.667}\ s^{0.5}) / n$	(ft/s)	2.00					
Flow length, L	(ft)	900					
$T_t = L / 3600\ V$	(hr)	0.13	+		=	0.13	hr

Watershed or subarea T_c or T_t	=	**0.40**	hr

Figure 5.7. Time of Concentration Worksheet for Example 5.3

Example 5.4 – Sizing of a Major Stormwater System

Based on **Cook County** topography, a proposed **development** has an offsite **drainage area** of 40 acres. Using **NRCS** TR-55 methodology, the CN was calculated to be 87 and the t_c was determined to be 1.2 hrs. Determine the **design runoff rate** that must be bypassed through the **site** and size a grassed swale to safely convey the flow.

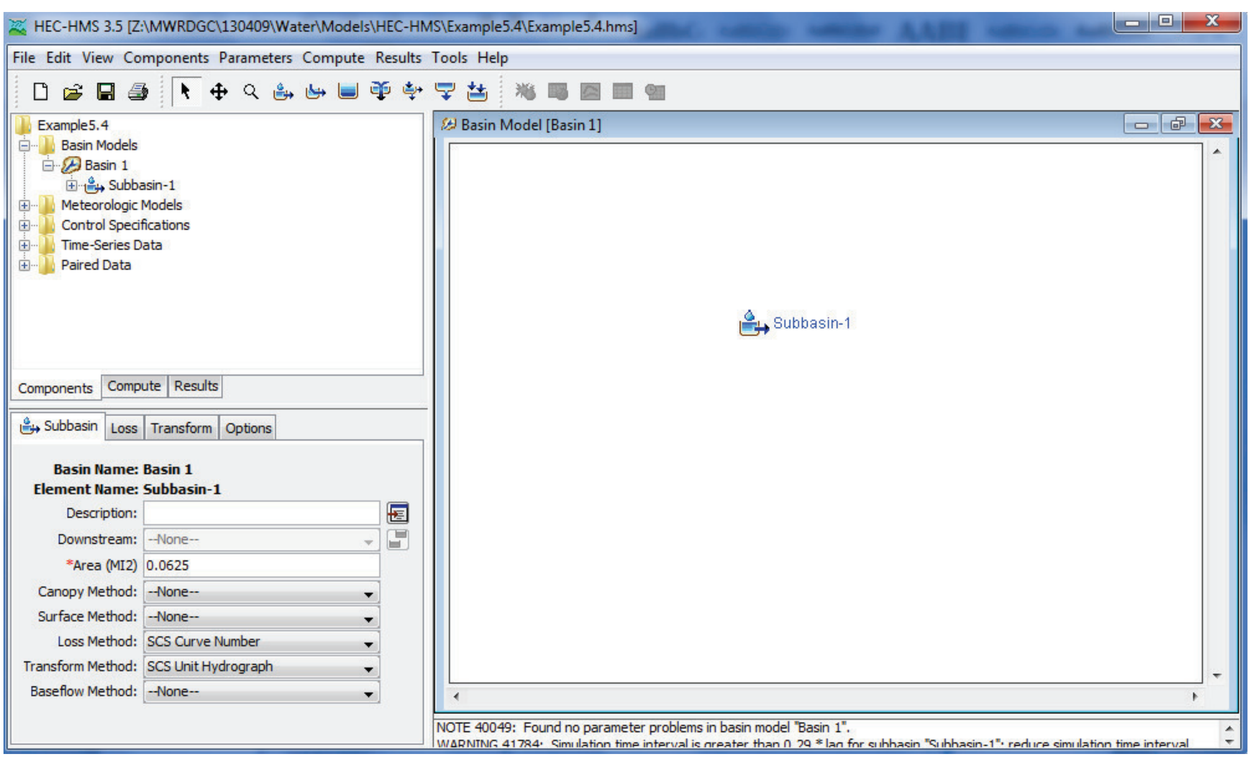
Solution: Use HEC-HMS to perform a **critical duration analysis** to determine the 100-year **design runoff rate**. Once the design flowrate is known, Manning's equation can be used to size the overland flow path.

Step 1: A one-subbasin HEC-HMS model was developed to represent the offsite area. The subbasin (named Subbasin-1) is the only component of the *Basin Model*.

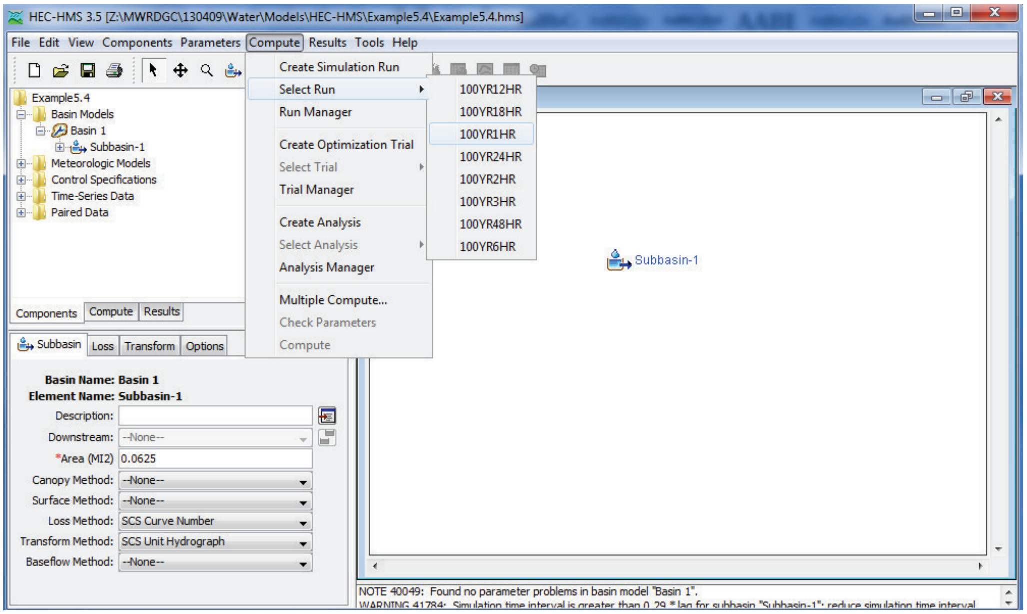
For Subbasin-1, enter the information for the project **site**:

- Area = 0.0625 square miles (40 acres)
- CN = 87
- Lag time = 0.72 hrs (0.6 * t_c)
- SCS CN and Unit Hydrograph Methodology

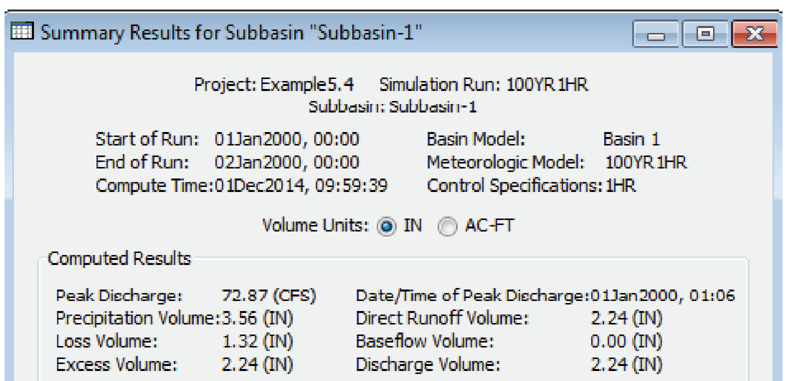
The *Meteorological Model* contains the rainfall depth information, which are the 100-year, 1-hour through 100-year, 48-hour depths from Table 5-6. The *Time-Series Data* contains the time distribution of rainfall, which includes the Huff 1st through 4th quartile distributions for various storm durations.



Create and compute simulation runs for the 100-year, 1-hour through 100-year, 48-hour storm durations.



The figure below shows the summary output for the 100-year, 1-hour **storm event**.

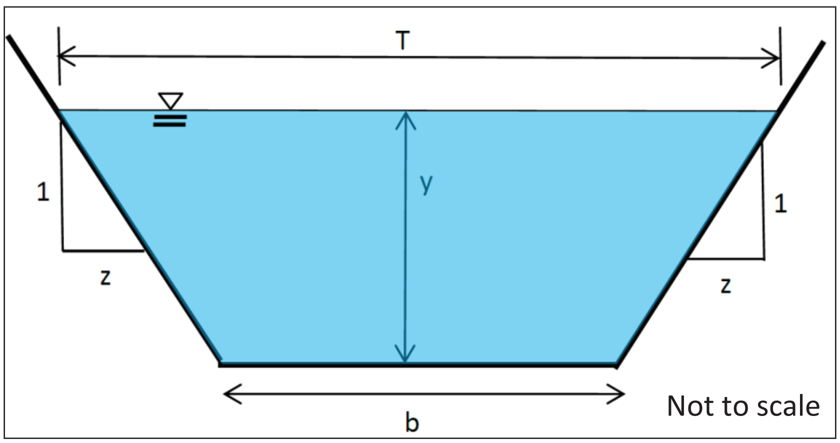


Because there is no summary output table for the various simulations, the results of the **critical duration analysis** have been summarized in the table below.

Storm event	Peak Flowrate (cfs)
100-Year, 1-Hour	73
100-Year, 2-Hour	**77**
100-Year, 3-Hour	70
100-Year, 6-Hour	56
100-Year, 12-Hour	42
100-Year, 18-Hour	35
100-Year, 24-Hour	29
100-Year, 48-Hour	17

As shown in the table above, the 100-year, 2-hour **storm event** yields the highest peak flowrate (77 cfs) for the offsite area.

Step 2: Using the peak 100-year flowrate computed from HEC-HMS, use Manning's equation to determine the geometry of the overland flow path to safely convey the offsite flow. From the **site** grades, the slope of the channel can be no more than 1%. Based on the elevations of adjacent homes, there can be no more than one foot of depth in the channel. The depth must be kept under one foot to provide the two feet of freeboard for the 100-year critical duration **storm event**.



Referring to the figure above, for a trapezoidal channel,

The flow area, A, is calculated by: $A = (b + zy)y$

The wetted perimeter, P_w, is calculated using: $P_w = b + 2y \times (1+z^2)^{0.5}$

The hydraulic radius, R, is calculated by: $R = A/P$

Since this is a grassed channel, the Manning's n value should be 0.035, as determined from Table 5-4. The slope s, is 1%, or 0.01 ft/ft and the flow depth, y, is equal to 1 ft. Side slopes, z, for the overland flow route should be equal to 3:1. This only leaves the bottom width, b, which can be adjusted until the capacity of the channel is greater than the 100-year design flowrate of 77 cfs. Solving Manning's equation iteratively, the required bottom width is 12 ft which yields a channel capacity of 79 cfs.

Minor and Major Stormwater System Design Considerations

Upstream flows must be considered when developing a **site**, as stated in the WMO (§502.9). Flows from the upstream **tributary areas** to the **site** should be computed under fully developed conditions to ensure the proposed **stormwater facilities** are not undersized. Upstream offsite flows cannot be blocked. Upstream flows can be routed around the **development** via **storm sewer** or swales and must be designed to convey the **base flood** event. Otherwise, the upstream flows can be routed into and through the **site stormwater facility** (including **site storm sewer**, swales, **site detention facilities**, etc.).

All systems should drain by gravity. Hydraulic grade line (HGL) computations must be provided to verify **buildings** and **structures** are properly protected from **flooding**. HGL computations must take into account appropriate tailwater conditions at the most downstream point of the proposed **stormwater** system (HWL, **BFE**, etc.). The rim elevations of all **storm sewer** manholes (catch basins, inlets, trench drains, area drains, etc.) must be at or above the high water elevation of the **site detention facility** or if an emergency overflow weir/spillway is provided, no lower than six (6) inches above the weir/spillway crest elevation.

Existing and proposed low-entry points and **buildings** should be considered when designing **major stormwater facilities**. A minimum of one foot must be provided from the maximum designed water surface elevation to the low-entry point of any **building**. This includes all **major stormwater facilities** (overland flow paths and **detention facilities**).

Design of drainageways should have:

1. Sufficient energy dissipation at the outlet to prevent scouring of the streambank, bed, or downstream land. Armoring of the stream channel should not be considered in lieu of energy dissipation. Energy dissipation is essential to avoid transferring scour and stability problems further downstream;

2. To the extent possible, deep-rooted vegetated side slopes, and inverts with velocities sufficiently limited shall be used to prevent scouring for open-channel drainageways. This guide addresses the plan requirement to control **sediment** and **erosion** from drainageways; and

3. Have reasonable side slopes given the engineering properties of the materials. A 3:1 side slope typically provides adequate stability in an earth channel and is a mowable slope. A 4:1 or shallower side slope is desirable. Deviations from the minimum value should be justified by appropriate calculations (e.g., slope stability calculations) and **maintenance** plans that do not require mowing.

Some areas within the **District** jurisdiction/boundaries have **combined sewer** systems. **Developments** shall provide separate **sanitary sewer** and **storm sewer** systems within the property boundaries of the **development**.

Runoff from rooftops, parking lots, and other impervious surfaces that do not discharge directly into a **site** detention system facility should discharge onto pervious surfaces. This will allow for infiltration, **runoff** reduction, and the improvement of water quality.

Stormwater System Easements

The WMO (§502.8) requires that **major and minor stormwater systems** be located within easements or public **right-of-way** explicitly providing public access for **maintenance** of such facilities. This includes **storm sewer** pipes, overland flow routes, swales, and portions of the curb and gutter system.

Easements should be sized to allow for the **maintenance** of the systems. A minimum of 10 feet should be dedicated over any **storm sewer** line or other conveyance facility. However, consideration should be given to the depth of **storm sewer** in order to allow for access to and **maintenance** of the lines. For example, a **storm sewer** line that is 30 feet deep will likely require more than a 10-foot easement, should **maintenance** be needed. Areas up to 10 feet beyond the established high water level of a **stormwater detention facility** should be placed within an easement.

Easement language should include **maintenance** access provisions for all **stormwater facilities**. Easements should be dedicated and recorded on all legal documents, including plats or titles of all **parcels** containing the easements. The dedication should indicate that the easement serves the purpose of allowing for the **maintenance** and access to the **stormwater facilities**.

Existing Sub-Surface Drainage (Drain Tile)

Per §502.7 of the WMO, the applicant shall locate all existing field tile systems on the project **site** plan. Drain tile can either be safely routed through or around the **development site**. The drain tile can be reconnected to the existing drain tile at the downstream side of the **development** or incorporated into the proposed **minor and major stormwater facility** of the **site** (only in **separate sewer areas**).

Any modifications to drain tile shall not cause damage to upstream, downstream, or adjacent **structures**, land uses, or **stormwater facilities**. Calculations will likely be required to demonstrate this. As the slope of the drain tile is often unknown, an estimate of the capacity of the pipe will have to be made based upon the known existing drain tile size and an estimated pipe slope.

Particular attention should be paid to those drain tile systems that are used to convey **upstream tributary flows**. Drain tiles must maintain drainage service to these upstream **tributary areas** during construction until the new **storm sewer** system is constructed. Drain tiles used as outlets must be within public **rights-of-way** or in an easement.

Any drain tile replaced onsite should be properly reconnected to the downstream system. Onsite drain tile should be located within a public **right-of-way** or a dedicated easement. This information should be shown on the **record drawings** with all appropriate rim, invert, pipe size, pipe material, etc. information shown.

Depressional Storage

Depressional storage is an above-ground storage area that does not have a gravity surface outlet and only drains by evaporation or infiltration. Up to the point of overtopping, a **depressional storage** area effectively reduces the flowrate of **stormwater runoff** leaving the **site** as it stores water onsite.

A hydrologic analysis for the pre-developed **site runoff** rate, which factors in the storage volume of the **depressional storage** area, shall be performed for the 2-year, 10-year and 100-year **storm events** of a 24-hour duration in accordance with §502.4 of the WMO. All areas tributary to the depressional area (both on- and offsite) should be considered in the hydrologic model. If the depressional area is contained onsite, a complete topographic survey with 1-foot contour intervals should be used to determine the relationship between the stage and storage values of the depression, which are to be included in the hydrologic model. If the depressional area extends offsite, **Cook County** one-foot topography may be used. For offsite areas that extend into other counties, the USGS topography maps can be used to complete a stage-storage relationship table. Any outlet from the depression, such as drain tile or an overflow weir, should be identified, and calculations are to be provided to determine the discharge rates from these **structures** as a component of the total existing release rate from the **site**.

The proposed **site's runoff** rate shall not exceed the existing **runoff** rate. A table of existing versus proposed flows and **flood** elevations should be provided for comparison purposes showing no increase in flows and **flood** elevations.

For those **sites** which require **site detention facilities**, the **allowable release rate** from the **site** shall be either equal to or less than the existing **runoff** rate. If the existing **runoff** rate is less than the calculated **allowable release rate**, the existing **runoff** rate becomes the **site's** new **allowable release rate**. The **site detention facility** shall be sized, accounting for the smaller of the two flow values.

If the depressional area is mapped as **floodplain** on the **FIRM** maps, the **floodplain** provisions of the WMO (Article 6) will apply.

Flow Depths on Roadways and Parking Lots

Maximum **flood** depths on any roadway for both storage and conveyance purposes shall not exceed 12 inches during the **base flood** condition. If located in the **regulatory floodway**, maximum **flood** depths on new parking lots shall not exceed 12 inches during the **base flood** condition. Parking areas that are located in the **floodplain** shall post signs indicating the **flood** hazard area. Figure 5.8 illustrates the acceptable **flood** depths on a roadway.

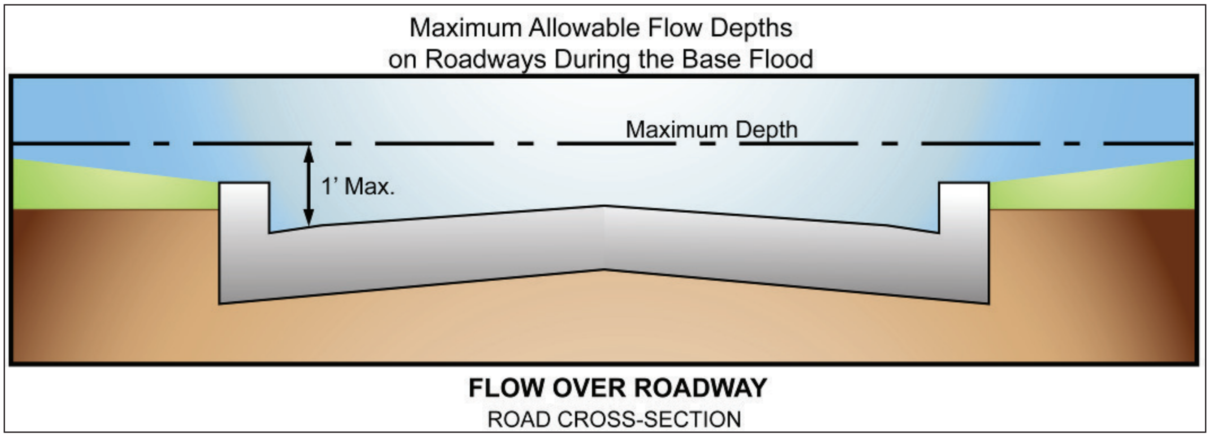


Figure 5.8. Allowable Flood Depths for Roadways

Building Protection Standards

For proposed **buildings** in areas adjacent to or within the limits of the **floodplain**, **building** protection standards are provided in Article 6 of the **TGM**. Proposed **buildings** shall be protected from **stormwater runoff** conveyed through the **site**. The proposed **buildings** shall be designed so that the lowest entry point for usable spaces shall be one foot above the high water elevation as determined from the design of the **major stormwater system** or overland flow paths. All usable space in new **buildings**, or added to existing **buildings**, adjacent to a **site detention facility** shall be elevated, **floodproofed**, or otherwise protected with a minimum of one foot of freeboard for the **base flood** condition to prevent the entry of surface **stormwater**.

SITE VOLUME CONTROL REQUIREMENTS (§503)

Introduction

The WMO (§503.2) requires that one (1) inch of **stormwater runoff** from all impervious surfaces of the **development** be treated using **volume control practices**. Impervious surfaces include: pavement and gravel paved areas, buildings, permanent pool areas, and wet bottomed detention ponds greater than 12-inches in depth. Synthetic turf fields and porous pavement areas are not considered impervious surfaces for purposes of volume control requirements.

The one (1) inch of **stormwater runoff** from these newly developed impervious areas is termed the **volume control storage**. The purpose of these practices is to provide pollutant and volume reduction mechanisms for **stormwater runoff** discharged from the **site** to receiving waters. The WMO presents a hierarchy of **volume control practices** in §503.3 to treat the **volume control storage** in §503.2:

1. **Retention-based practices** with quantifiable storage capacity are the primary form of water quality treatment. The use of **retention-based practices** must be maximized for treating the **volume control storage**; and

2. **Flow-through practices** are required for treatment of any portion of the **volume control storage** that has not been treated using **retention-based practices**."

3. **Redevelopments** with **site** constraints that prevent use of **retention-based practices** to retain the **volume control storage** in full, the **volume control storage** may be reduced by twenty-five percent (25%) for every five-percent (5%) of reduced **impervious area**, if the **development** can meet the conditions provide in §503.3.C of the WMO.

As presented in Table 5-1 of the **TGM** and in §503.1 of the WMO, the volume control requirements apply to:

1. **Residential subdivision development** on **parcels** totaling one (1) acre or more; and/or

2. **Non-residential** or **multi-family residential development** on **parcels** totaling 0.5 acre or more; and/or

3. Roadway **development** that is more than one (1) acre of **new impervious area**, where practicable.

The selection of **volume control practices** should be based on the **site** feasibility, which includes soil suitability. The design of **volume control practices** must be incorporated into the overall **site** design while meeting the **site runoff** requirements of §502 and the **site detention facility** requirements of §504.

For **developments** that require a permit and the ownership area is greater than or equal to the thresholds specified in Table 5-1, **volume control practices** are generally required for the proposed **impervious area**. However, if the area of **development** is less than or equal to 0.1 acre, the volume control requirements do not apply. The following example demonstrates this point:

Commercial Development
Total **Development** Area = 0.49 acre
Total Ownership Area = 1.0 acre
Proposed **Impervious area** = 0.34 acre
Includes Qualified Sewer Construction
Is Volume Control Storage Required? Yes

Although the disturbance is less than 0.5 acre, a permit is required for the **development** since it includes **qualified sewer construction**. Because the ownership area is greater than 0.5 acre (from Table 5-1) and the **development** area is greater than 0.1 acre, the **volume control storage** will have to be provided for the 0.34 acre of proposed **impervious area**.

Impervious Area Reduction

As stated in §503.3.C of the WMO, **redevelopments** with site constraints that prevent the use of **retention based** practices may reduce the **impervious area** to meet the volume control requirements. The **volume control storage** may be reduced by twenty-five percent (25%) for every five-percent (5%) of reduced **impervious area**. Therefore, credit for the entire required **volume control storage** (100%) can be provided by reducing the **impervious area** by 20%. This concept is illustrated in Figure 5.9 below.

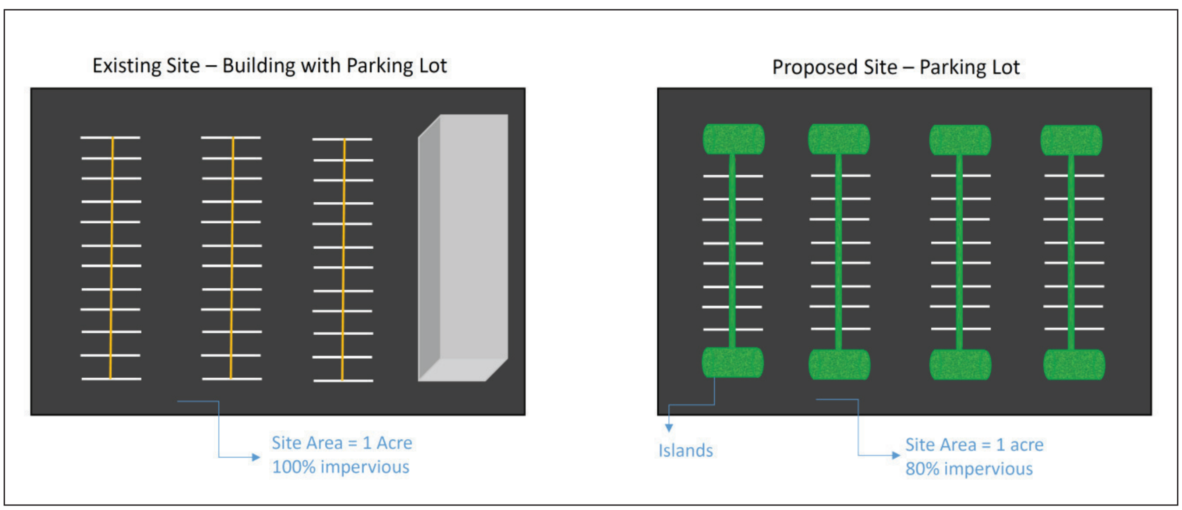


Figure 5.9. Reduction in Impervious Area to Meet Volume Control Requirements

Volume Control Practices Overview

Volume control practices utilize designated infiltration areas or **structures** to capture a portion of **stormwater runoff** (i.e., the **volume control storage**) and retain it onsite such that the **runoff** is able to 1) percolate through (or into) the underlying soils, 2) evaporate, 3) dissipate through evapotranspiration by plants, or 4) drain back slowly into the minor system via underdrains. The process of percolating **runoff** through the soil is an effective mechanism for both **site runoff** volume reduction and pollutant removal. Pollutants such as fine **sediment**, nutrients, bacteria, and organic materials can be filtered, absorbed by soil particles, or utilized by plants, thus providing a water quality benefit.

Since **volume control practices** reduce the quantity of **stormwater runoff** discharged from the **site**, "credit" for these practices provided in §503 may be applied to the **site** detention requirements in §504, when applicable. In other words, the total required **site** detention volume may be reduced by the volume stored within **volume control practices**. Additionally, **site detention facilities** may be modified by storing the **volume control storage** below the outlet restrictor. Credits and approaches for **volume control storage** are discussed in detail later in this section.

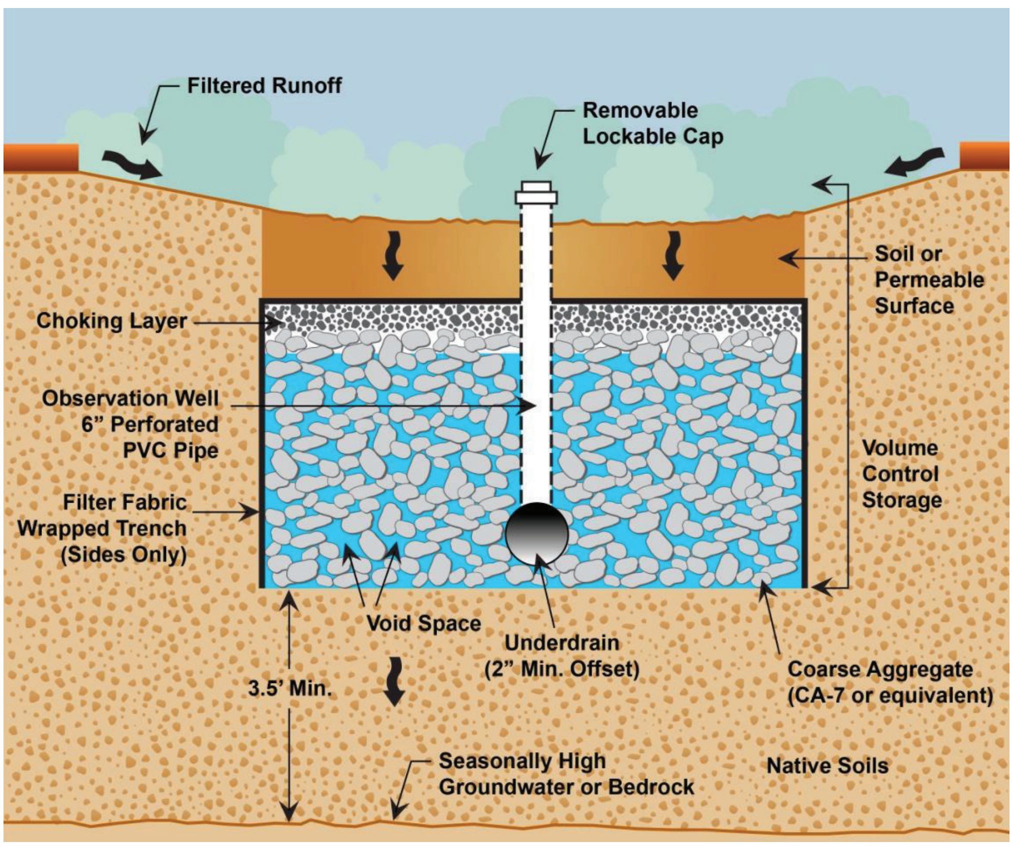


Figure 5.10. Example of Volume Control Practice

Flow-Through Practices

Flow-through practices are designed to provide water quality treatment by filtering out pollutants from the **runoff** before it is discharged from the **site**. Many **flow-through practices** provide some infiltration, however the volume reduction is not quantifiable. Many **flow-through practices** are conveyance systems that provide **stormwater** treatment along the flow path. For most practices, this is in the form of a series of vegetated swales, filter strips, or mechanical **structures** such as oil and grit separators. These practices should be sized to allow sufficient contact time with the treatment practice, such as shallow water depths and low velocities, in order for adequate pollutant removal to occur. **Flow-through practices** utilize deep-rooted plants that can trap suspended **sediment** and incorporate nutrients into their biomass as water flows through the practice.

Figure 5.11. Flow-Through Practice

For the purposes of the WMO, **flow-through practices** also serve as pretreatment practices to protect the functionality of **volume control practices**. **Flow-through practices** are not required for **stormwater runoff** that has originated from roofs.

Site Feasibility Assessment

A **site** feasibility assessment that examines **site** limitations is necessary to determine the appropriate approach for **volume control practice** design. **Volume control practices** should be located on soils that are significantly permeable to ensure that the captured volume of **runoff** can infiltrate and dewater the **structure** at a minimum rate of 0.5 inches per hour. Other considerations, such as the **groundwater** table and discharge of **volume control practice** overflows, should be examined and used in the design. Installing retention based **volume control practices** within a **floodway** is prohibited due to the risk of washout from deep and swift flood waters in these flood prone areas.

Soil Suitability

Retention-based practices require soils with appropriate infiltration capacity. The infiltration rate is strongly influenced by the proportion of sand, silt, and clay (texture). Predominately clay soils have infiltration rates that are too low (in inches per hour) to accommodate the volume of **volume control practices** and predominately sandy soils can infiltrate **runoff** too rapidly and adversely impact **groundwater**. In addition to infiltration capacity, the soils must be free of contaminants, which can also adversely impact **groundwater**. Therefore, **sites** with contaminated soils are not suitable for **volume control practices**.

Onsite soils must be tested in order to determine if they are appropriate for **volume control practices**. Testing must include a determination of the soil type(s) and the infiltration capacity, including the capacity of the soils at the base of the **structure**.

Soil borings or pits should be taken in the location of the proposed **volume control practice** to verify soil particle size distribution (textural class) and to determine the depth to **groundwater** and bedrock. The number of soil borings should be selected as needed to determine soil conditions. The minimum depth of the soil borings or pits must be five feet below the bottom elevation of the proposed **volume control practice**. This serves the purpose of determining the location of the seasonally-high **groundwater** table. Infiltration tests should be conducted at the proposed bottom elevation of the **volume control practice**. The infiltration rate must be measured with a double-ring infiltrometer and meet the requirements of ASTM D3385. For sites where the double-ring infiltrometer test is impractical, the single-ring infiltrometer test may be used, provided that the testing follows the procedure contained on Page 28 of the City of Chicago Stormwater Ordinance Manual (March 2014).

Soils must have sufficient infiltration capacity to accept the **volume control storage**. The infiltration range of onsite soils for **volume control practices** should be between 0.5 and 2.41 inches per hour. These restrictions limit the use of **volume control practices** to soils with textures of sandy loam, loam, silt loam, silt, most sandy clay loams, and only some clay loams and silty clay loams.

In the event that a natural depression is proposed to be used as a **volume control practice**, the applicant must demonstrate the following information:

1. Infiltration capacity of the soils under existing conditions (inches/hour);

2. Existing drawdown time for the high water level (HWL) and a natural overflow elevation; and

3. Operation of the natural depression under post-**development** conditions mimics the **hydrology** of the system under pre-**development** conditions.

Poor infiltration rates (< 0.5 inches/hour) are common in **Cook County** and do not prevent the use of **retention-based practices**. If onsite soils do not provide a suitable infiltration rate, the design of the **volume control practice** should incorporate the use of an underdrain system. As described in the next section, only certain site constraints (contaminated soils or high groundwater levels) are acceptable reasons for not providing **retention-based practices.**

Retention-Based Practices in Sandy Soils

Soils with large percentages of sand generally infiltrate water more quickly than finer textured soils, and therefore, are effective with retention-based practices, provided that precautions are taken to protect the groundwater. The level of treatment in sandy soils, however, is quite variable. Sands can be ideal for filtration of particulate material, whereas soluble pollutants generally move through the soil quite rapidly and unattenuated. Soil cleansing via filtration, adsorption, and microbial uptake can be very effective removal processes for some of the more difficult-to-treat runoff pollutants. However, soils that infiltrate too rapidly may not provide enough time for sufficient treatment, creating the potential for groundwater contamination.

Contaminated Sites

There are sites, such as those previously used as gas stations or sites with known contaminants (based on a Phase I Environmental Site Assessment), where it would be impractical to use retention-based practices. For these sites, the WMO volume control requirements can be met by providing **flow-through practices** or a reduction in **impervious area**.

Groundwater Analysis

An investigation into the location of the seasonally-high **groundwater** table must be carried out in order to avoid **groundwater** contamination. In **combined sewer areas**, the seasonally-high **groundwater** table must be at a minimum of 3.5 feet below the bottom of the proposed **volume control practice** to allow for treatment of collected **runoff** prior to it entering the **groundwater** system (2 feet in **separate sewer areas**). If soil borings or pits do not show the seasonally-high **groundwater** table to be within 3.5 (or 2) feet of the bottom of the proposed **volume control practice**, then further investigation is not required.

For instances where the seasonally-high **groundwater** table is within 3.5 (or 2) feet of the bottom of the proposed **volume control practice**, then the proposed **volume control practice** must be relocated or redesigned such that a minimum of 3.5 (or 2) feet is maintained.

Volume Control Practices for Site Development

The WMO (§503.3.A) requires that **volume control practices** must be sized to retain and/or infiltrate the **volume control storage**. The **volume control storage** is equal to one (1) inch of **runoff** from the impervious surfaces of the **development**. The **volume control practices** can include:

- Infiltration Trenches*
- Infiltration Basins*
- Porous Pavement (storage in the voids below the pavement)

- Bio-Retention Systems*
- Dry Wells
- Open Channel Practices Fitted With Check **Dams***
- Storage Below the Outlet of a **Site Detention facility***
- Constructed **Wetlands** that have Forebays, Deepwater Zones, and Micropools

As discussed above, pretreatment measures to protect the functionality of **volume control practices** are required where necessary. The **volume control practices** marked with an asterisk (*) will usually require pretreatment. A summary of the pretreatment measures that may be used for various volume control practices is included in Table 5-11.

Depending on the volume control practice, the storage volume may consist of surface storage, storage in the voids of growing media, and/or storage in the void space of aggregate. The aggregate layer may be incorporated into a number of practices ranging from infiltration trenches to porous pavements. Many **volume control practices** are in the form of reservoirs filled with coarse aggregate with no outlet beneath a vegetated depressional area (such as with bio-retention systems). When coarse aggregate is used, the capacity of the reservoir is determined by the void space of the coarse aggregate used in the system. If the infiltration rate of the underlying soil is less than 0.5 inches/hour, an underdrain must be used to drain the accumulated volume of **runoff**.

There can be a great deal of flexibility in the types of practices selected as well as the location and configuration of these practices onsite. For example, the dimensions (length, width, and depth) of these practices can be manipulated such that they can take on irregular shapes, thereby allowing for easier integration into the **site** design, such as along property lines, in parking lot islands, or unusable portions of the **site**. Additionally, underground storage can be provided using the stone voids under permeable pavement, and other systems can be designed to function below **impervious areas**.

Volume Control Practice Sizing and Drainage Criteria

Calculate Required Volume Control Storage

Determine the portion of the **volume control storage** that will need to be treated with **volume control practices**. The **volume control storage** is equal to one inch of **runoff** from the impervious surfaces of the **development**. This volume is best represented in cubic feet.

$$V_C = Std_C \times \text{Unit Conversion} \times A_{IMPV}$$

Where:	V_C	=	**Volume control storage** (cubic feet)
	Std_C	=	Control Standard = 1.0 in.
	Unit Conversion	=	1 ft/12 in.
	A_{IMPV}	=	Proposed **Impervious area** (ft^2)

The dimensions of the **volume control practices** will be a combination of the depth and surface area available to retain the **volume control storage**. In order to minimize the footprint of the practice, the allowable depth is often the limiting factor. The maximum allowable depth is determined by the depth necessary to maintain a 3.5 foot separation from the seasonally high **groundwater** level, bedrock, or other limiting layer (3.5 feet in **combined sewer areas**, 2 feet in **separate sewer areas**). The surface area of the **volume control practice** is determined using the design volume and final depth values.

All **volume control practices** must have quantifiable storage space to retain the calculated **volume control storage**. Depending on the volume control practice, the storage volume may consist of surface storage, storage in the voids of growing media, and/or storage in the void space of aggregate.

The capacity of an aggregate-filled reservoir to retain the **volume control storage** should be based on the volume of void space (% porosity) of the coarse aggregate used in the system, where the volume of voids is equal to the **volume control storage**. If test data is not available, use 36% porosity for the coarse aggregate. The size of an aggregate-filled reservoir can be computed by converting the **volume control storage** to reservoir volume:

$$V_{RES\ REQ'D} = V_C \times \frac{100}{\%\ \text{Void Space}}$$

Where: $V_{RES\ REQ'D}$ = Required Reservoir Volume (cubic feet) = volume of voids + volume of aggregate (This is the volume necessary to contain the coarse aggregate and the **volume control storage**.)

V_C = **Volume control storage** (cubic feet)

Perforated underdrain is required for each volume control **retention-based practice** due to the region's typical clayey soils where infiltration rates are assumed to be low. In most cases, a required underdrain should be no larger than 4-inches in diameter to encourage retention, have an observation well installed at the terminal end, be spaced no more than 30 feet on center across a retention field area, and laid with the perforations on the bottom of the pipe. Void volume credit available below the invert of the perforated underdrain must be limited to no more than 12-inches and will be credited at 100% toward volume control requirements. Void volumes below the underdrain invert must extend across the entire volume control storage system, and not limited to only an underdrain trenched area. Void volume above the invert of the underdrain up to the ground surface will be deducted by a factor of 50% to account for losses out of the underdrain. When calculating the storage volume in aggregate a void volume of 0.36 is used. A void ratio of 0.25 is used for growing media.

Volume provided above the ground surface will be limited in depth to 12-inches of wetland ponding and credited at 100%. For calculating surface **volume control storage**, the average end area method between the ground elevation and the elevation of the overflow grate/outlet pipe/check dam is recommended. Wet ponding depths above one foot of depth are not considered volume control and are considered impervious areas. For more information, see the **volume control practice** details located in Appendix C of the **TGM.**

If high infiltrating soils are suspected, provide a detailed soils report documenting the additional in situ percolation tests to confirm actual infiltration rates and to allow for design of a volume control facility without underdrains and take credit for additional infiltrative release.

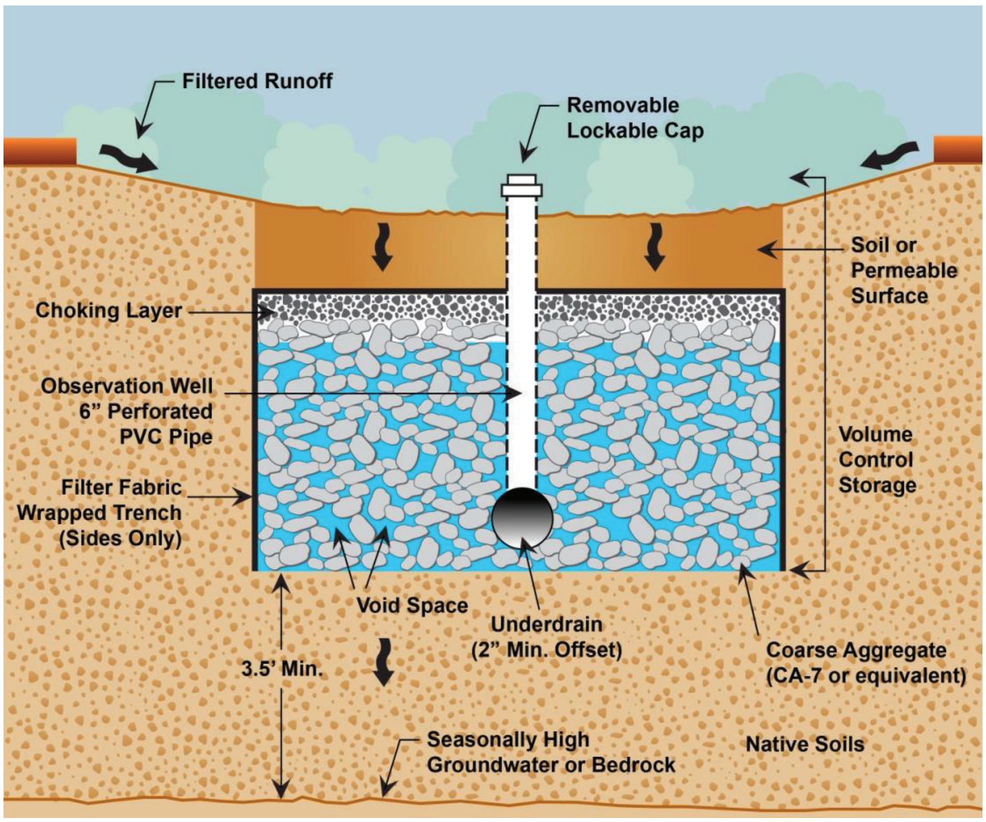


Figure 5.12. Volume Control Practice – Surface Storage, Media Storage and Aggregate Storage

<u>Volume Control Practice Site Location</u>

Determine how **volume control practices** will fit into the **development site** design (on available pervious area of the **development**), and select the appropriate **volume control practice**. Information collected during the **site** feasibility assessment should identify the potential for multiple **volume control practices** versus relying on a single **volume control practice**. Again, **volume control practices** should be located on soils that are significantly permeable to ensure the captured **volume control storage** can infiltrate and dewater the **structure** at a minimum rate of 0.5 inches per hour.

The following should be considered when determining the location of **volume control practices**:

1. Conveyance path of the **runoff** to the practice;

2. Overland flow path from the practice to the main drainage system;

3. Practices should be a minimum of 10 feet from a **building** foundation (unless waterproofed), 20 feet from a **sanitary sewer**, and 100 feet from potable water wells and septic tanks;

4. Practices should not be installed on slopes greater than 15;

5. Practices should not be installed above soils that are considered fill; and

6. A minimum setback of 20 feet from a road's gravel shoulder is required to ensure that the practices do not cause frost heaving.

Volume Control Storage Design

The **volume control practice** should be filled with coarse aggregate that meets **IDOT** Section CA-7 quality and gradation. Other types of coarse aggregate will be permitted, provided that it is crushed angular stone that is clean and washed free of fines. A void ratio of 0.36 is used when calculating the storage volume in aggregate. For growing media, a void ratio of 0.25 applies. A layer of choking stone or filter fabric must separate the growing media from thecoarse aggregate, and/or sand layers. No filter fabric shall be placed along the bottom of the trench between the volume control media and the native subsoil. Filter fabric must wrap along the trenching sides to prevent soils migration from clogging the system. The filter fabric should meet the requirements of the ***Illinois Urban Manual*** *Material Specifications 592* for geotextile fabric.

The storage reservoir should have direct access for **maintenance activities**. An observation well (e.g., a perforated PVC pipe that leads to the bottom of the **structure**) is needed to enable inspectors to visually monitor the drawdown rate of the water. For more information, see the observation well detail located in Appendix C of the **TGM.** One well per 40,000 ft^2 of practice surface area is required. Where infiltration rates of the soil are less than 0.5 inches per hour, v**olume control practices** must incorporate an underdrain pipe that will allow the **structure** to be dewatered within 72 hours or less, if the **structure** becomes clogged. An underdrain can be a perforated pipe system in a gravel bed, installed at the base of the **structure** (minimum of 2" and maximum of 12" from the bottom) to collect and remove filtered **runoff**. The period of inundation is defined as the time from the high water level in the practice to one to two inches above the bottom of the facility (see Figure 5.12). This criterion was established to provide:

1. Wet-dry cycling between rainfall events;

2. Unsuitable mosquito breeding habitat;

3. Suitable habitat for vegetation;

4. Aerobic conditions; and

5. Storage for back-to-back precipitation events.

Additional details and specifications for the design of **volume control practices** are provided in this article and in Appendix C of the **TGM**:

- Underdrain
- Coarse aggregate
- Filter fabric
- Monitoring well
- Turf fields

Overflow Path from Volume Control Practice

In addition to a conveyance design that routes flows to a **volume control practice**, an equally important consideration is a conveyance design that routes flows from the practice back to the main drainage system. The overflow path is a necessary component designed to prevent structural damage to the **volume control practice** from localized **flooding** in the event that the practice does not dewater fast enough to prevent an overflow. Overflows can occur as a result of clogging or during long-duration, high-intensity **storm events** that raise the **groundwater** level to an elevation that impedes infiltration. Therefore, overflow designs should route excess flows through a **stabilized** discharge point that allows these flows to be directed back to the main drainage system in a controlled manner that will not cause scour.

Protection of Volume Control Facilities During Construction

Volume control practices are susceptible to failure during construction and therefore it is important that staging, construction practices, and **erosion and sediment control practices** all be considered during their installation. To protect the long-term functionality of volume control practices, the following measures should be addressed in the construction sequencing, general notes, and/or **soil erosion and sediment control** plan for a **development**:

- **Volume control practices** should be installed toward the end of the construction period.
- The contributing **drainage area** must be stabilized prior to the installation of the **volume control practice**.
- Soil compaction shall be minimized as much as possible during **site** grading. Appropriate measures (such as fencing) should be used to prevent heavy construction equipment traffic from accessing the area.
- **Volume control facilities** must be protected with a double-row of silt fence (or equivalent measure) during construction. The two layers of silt fence should be placed at least 5 feet apart and must follow the ***Illinois Urban Manual*** standards.

- In general, **volume control facilities** should not be used as temporary sediment traps during construction. For **sites** where this is not practicable, special construction notes and/or details are required to protect the functionality of the facility.

Protection of Volume Control Practice Infiltration Capacity: Pretreatment

Pretreatment is critical for **runoff** entering **volume control practices** in order to prevent clogging within the **volume control practice**. This reduces **maintenance** and also provides an added level of protection against **groundwater** contamination. §503.3.A (3) of the WMO requires, where necessary, pretreatment of **runoff** entering a **volume control practice** to protect the functionality of the **structure**. Where practicable, **flow-through practices** such as vegetated swales or filter strips should be used to meet the pretreatment requirement. Additionally, upland drainage should be properly **stabilized** both during and after construction to reduce **erosion**, thus minimizing the **sediment** loads being delivered to the **structure**. The use of trash racks or downspout screens will also satisfy the pretreatment requirements in some cases, as these measures prevent debris from clogging the **volume control practice**. Table 5-11 provides a summary of pretreatment measures that may be used for various volume control practices.

<u>Flow-through Practices for Site Development</u>

The WMO (§503.3.B) requires **flow-through practices** for treatment of any portion of the **volume control storage** that has not been treated using **volume control practices**. **Flow-through practices** must be sized to filter or detain the **volume control storage** as it passes through the **structure**. Maximizing the contact time between the vegetation and the **runoff** is critical to the effectiveness of **flow-through practices** to provide adequate treatment. Vegetation selection varies depending on climate, soil type, topography, land use, available light (shade tolerance), aesthetics, and planned use of the area.

Flow-through practices include, but are not limited to:

- Vegetated Filter Strips;
- Bio Swales;
- Constructed **Wetlands**;
- Catch Basin Inserts; and
- Oil and Grit Separators.

Again, any of these practices are also a suitable form of pretreatment for **volume control practices** and **site detention facilities** (detention ponds). However, these practices are not appropriate for all **sites** due to several limitations, particularly in **redevelopment** areas.

Providing vegetated **flow-through practices** may be difficult in many **redevelopment** areas due to the lack of ideal soils capable of supporting hearty vegetative growth. Many soils have undergone significant compaction and nutrient loss, which can limit root **development** and proper drainage. **Flow-through practices** can also have the potential to interfere with existing infrastructure and practice design should be considered accordingly.

Flow-through Practice Sizing and Criteria

Calculate Volume Control Storage for Flow-Through Treatment

Determine the portion of the **volume control storage** that will need to be treated with **flow-through practices**. The **volume control storage** is equal to one inch of **runoff** from the impervious surfaces created by the **development**. If a portion of the **volume control storage** is to be treated by **volume control practices**, subtract that portion from the **volume control storage** to determine the volume to be treated by **flow-through practices**.

- First, Calculate Volume to be Treated Using a **Volume Control Practice:**

$$V_{C\ RET} = V_C \times \%_{RET}$$

Where:

Where:	$V_{C\ RET}$	=	Portion of **volume control storage** in **Volume Control Practice** (ft^3)
	V_C	=	**Volume control storage** (ft^3)
	$\%_{RET}$	=	Portion of **volume control storage** in **Volume Control Practice** (%)

- Then, Calculate Volume to be Treated Using a **Flow-Through Practice**

$$V_{C\ FLW} = V_C - V_{C\ RET}$$

Where:	$V_{C\ FLW}$	=	Portion of **volume control storage** in **Flow-Through Practice** (ft^3)
	V_C	=	**Volume control storage** (ft^3)
	$V_{C\ RET}$	=	Portion of **volume control storage** in **Volume Control Practice** (ft^3)

Volume Control Examples

This section provides examples of the five most common **volume control practices** that have been utilized in **Cook County**. There are additional acceptable **volume control practices** that have not been addressed in the **TGM**. These practices are itemized in §503.3.B of the WMO.

Porous (Permeable) Pavement

The concept of porous pavement is to allow rainwater to infiltrate into and through the surfaces of parking lots, streets, and other traditional impervious surfaces. When designing a porous surface, the designer must carefully evaluate where the infiltrated rainwater is draining and how the **stormwater** is being conveyed.

The main benefits of porous pavements are increased **stormwater** infiltration, decreased surface **runoff**, improved water quality, and reduction in **runoff** velocity. Porous pavements are particularly important in filtering the first flush pollutants commonly observed at the beginning of a **storm event**. First flush pollutants are present on the land surface before the **storm event** and typically include car oil, gasoline, trash, road salt and suspended solids.

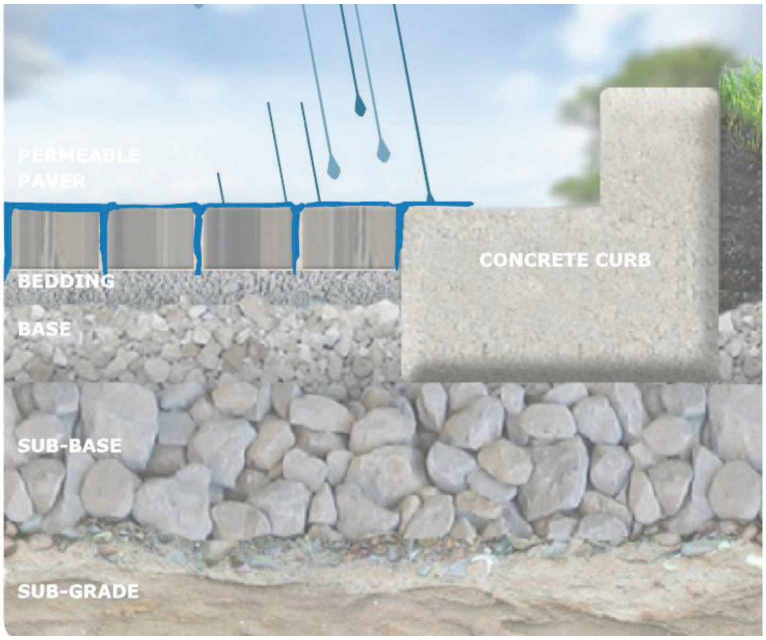


Figure 5.13. Example of a Permeable Paver Parking Lot Cross-Section (APT, 2011)

Design Considerations:

- There are several pavement options: pervious concrete, permeable pavers, and porous asphalt (not preferred).
- Must be sized and designed based on **drainage area**, structural requirements, soils, and the **volume control storage**.
- Underdrains may be used to provide drainage unless infiltration rate is greater than 0.5 inches/hour.
- **Maintenance** is necessary to ensure long-term functionality. **Maintenance** procedures include: sweeping organic materials off of gravel-filled pavers, and conventional street-sweeping with vacuums, brushes, and water to clear out voids (aggregate fill may be needed following each cleaning to refill the voids). Schedule R and Exhibit R must be submitted for the volume control facility, as well as a detail drawing of proposed signage, as required.
- This practice should be used with caution in areas underlain with highly permeable soils (i.e., surface sand or gravel) where infiltrated pollutants could reach **groundwater** without opportunity for attenuation.
- The effects of subgrade compaction, freeze-thaw cycles, de-icing, and snow removal must be considered in determining the applicability of this practice.
- The bottom should be at least 3.5 feet above the seasonal high water table (in **combined sewer areas**, 2 feet in **separate sewer areas**) and as level as possible in order to uniformly distribute infiltration to the surrounding soil.

For additional design considerations for porous pavement, the **Illinois Urban Manual** practice standard is available on-line at: http://aiswcd.org/IUM/standards/urbst890.html.

Dry Wells

A dry well consists of an excavated area which is backfilled with aggregate to temporarily store and infiltrate **stormwater runoff** from rooftops. Their typical application is for single family residences. The purpose of the dry well is to reduce **runoff** volume and peak discharges from a **development**. They also have the ability to filter soluble contaminants out of the **stormwater runoff**.

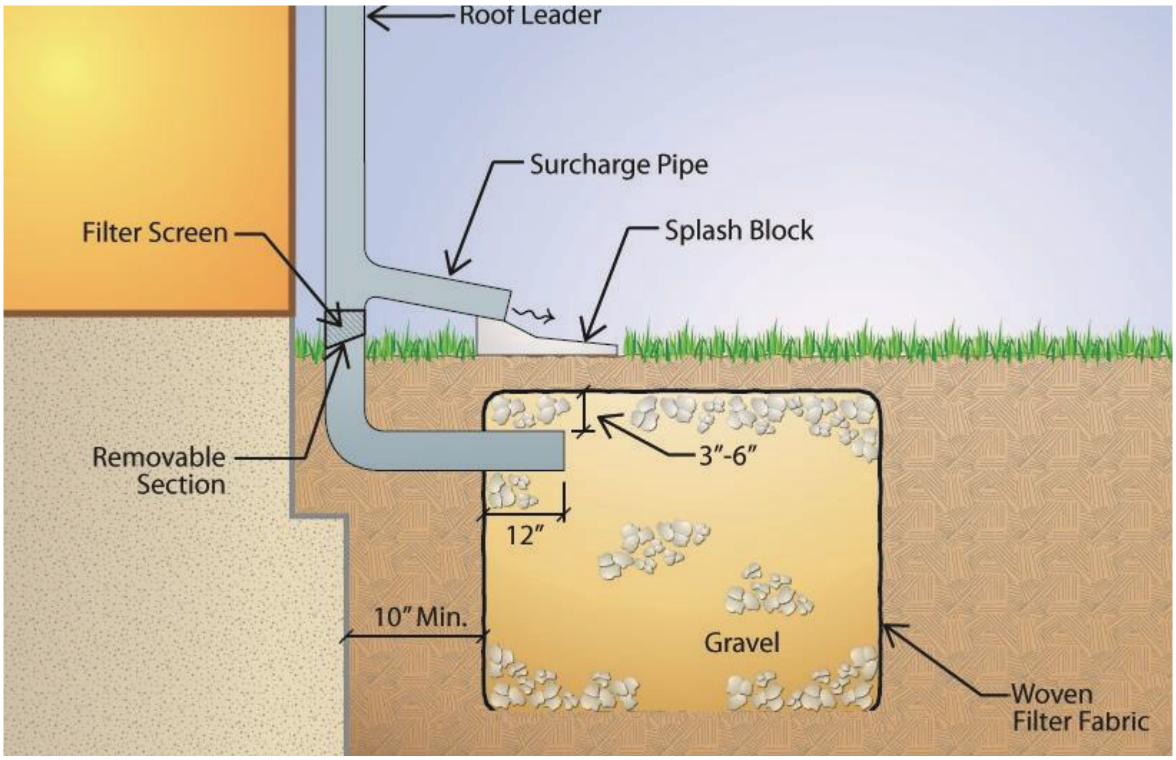


Figure 5.14. Typical Cross-section for Dry Well

Design Considerations:

- Must be sized and designed based on the **drainage area**, soils, and **volume control storage**.
- Dry wells can be constructed in two different forms: either a structural chamber that is assembled or inserted into an excavated pit, or an excavated pit filled with aggregate.
- It is important that the location of the dry well is adequately placed so that it does not cause **basement** seepage, **flooding**, or ponding at the ground surface.
- Dry wells should drain accumulated volume within 72 hours.
- They must be sized with consideration of both **drainage area** (1 acre maximum) and soil type (sandy soils will drain much more quickly than clay dominated soils).

- The bottom of the well should be at least 3.5 feet above the seasonal high water table (in **combined sewer areas**, 2 feet in **separate sewer areas**) and as level as possible in order to uniformly distribute infiltration to the surrounding soil.
- Dry wells should be protected from construction **site runoff** to prevent clogging.
- Dry well use is restricted by concerns of **site** feasibility, soil types, clogging, seasonally high **groundwater**, and bedrock.

For additional design considerations for dry wells, the **Illinois Urban Manual** practice standard is available on-line at: http://aiswcd.org/IUM/standards/urbst847.html.

Bio-retention System

Bio-retention systems consist of landscaped areas that are designed to intercept, infiltrate, and store **stormwater runoff** from the **site**. A permeable soil layer allows **stormwater runoff** to infiltrate to a layer of coarse aggregate, where **stormwater** can be stored in the void space of the stone. Bio-retention systems provide surface storage (between the ground elevation and the elevation of the overflow grate), storage in the void space of the growing media, and storage in the void space of aggregate.

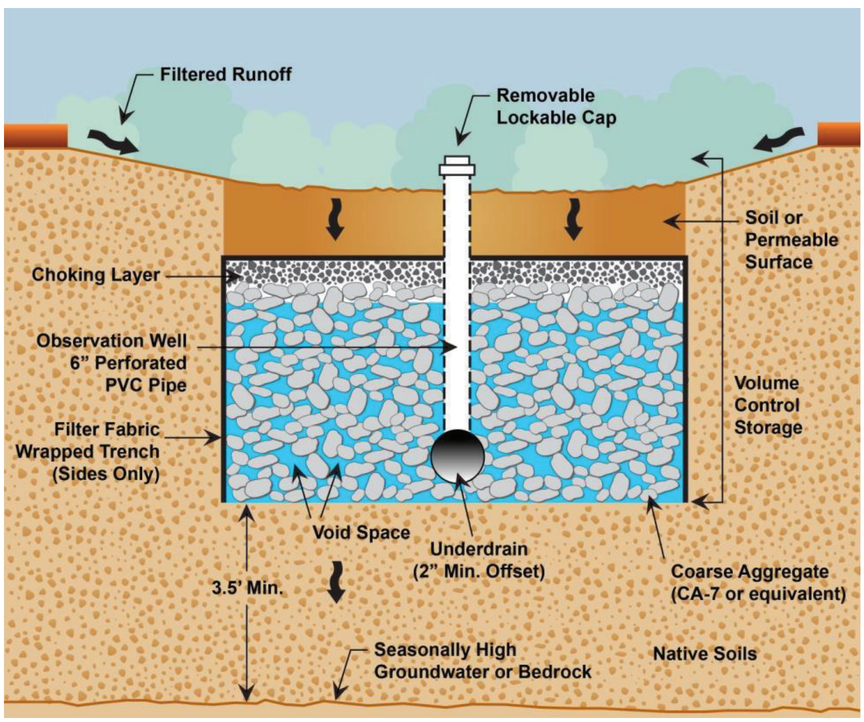


Figure 5.15. Typical Cross-section for Bio-retention System

Design Considerations:

- Bio-retention Systems are commonly located in parking lot islands or as small pockets within residential land uses.
- **Runoff** can be drained to Bio-retention Systems using curb cuts or wheel stops.

- They must be sized and designed based on **drainage area**, soils, and the **volume control storage**.
- Generally, a one- to three-foot gravel layer wrapped in a woven geotextile provides temporary **stormwater** storage. However, this may vary depending on the amount of storage needed to meet the volume control requirement.
- Mix should be 50% sand, 30% organic (e.g. aged composted leaf mulch), 20% high quality topsoil (minimal clay content). Several District mixes, which vary by the underlying soil type, are also acceptable and consist of the following:

  <u>Mix-1, for Area Where Native Soil is Clay</u>
  50% sand, 50 % **District** composted biosolids or any other compost
  (Incorporate in top 4-inches)

  <u>Mix-2, for Areas Where Native Soil is Sandy</u>
  40% top soil, 60% **District** composted biosolids or any other compost
  (Incorporate in top 4-inches)

  <u>Mix-3, for Areas Where Native Soil is Loamy</u>
  25 % Sand, 75 % **District** composted biosolids or any other compost
  (Incorporate in top 4-inches)

- The mulch layer should consist of shredded hardwood mulch (commercial), **District's** unscreened composted biosolids, or another non-floating mulch.
- During smaller **storm events**, **runoff** filters through the mulch and prepared soil mix is collected in a perforated underdrain and returned to the storm drain system. **Runoff** from larger storms is generally diverted past the bio-retention system to the **storm sewer** system.
- Additional design details are available on-line at: http://www.stormwatercenter.net/.

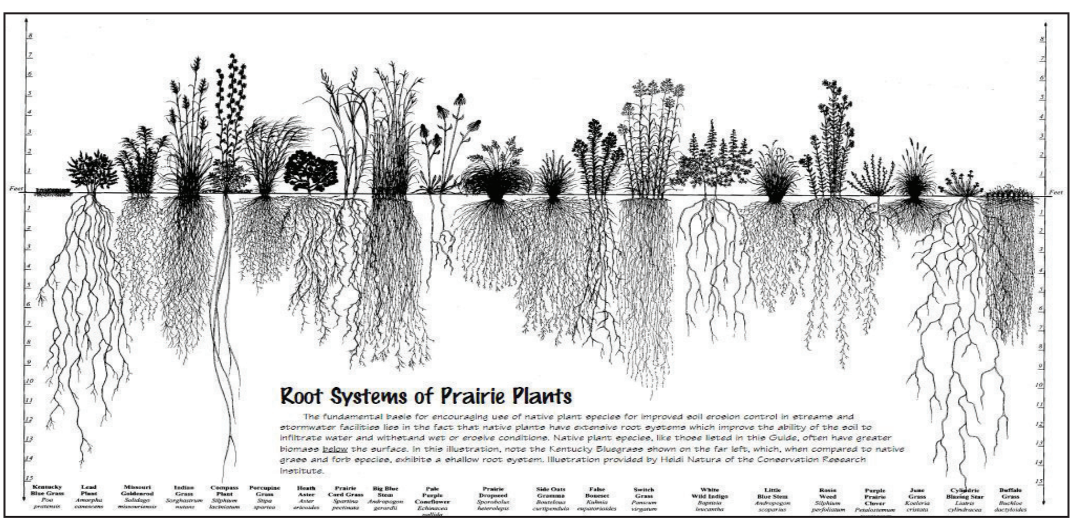


Figure 5.16. Root Systems of Grass and Prairie Plants (Source: Heidi Natura, CRI, 1995).

Water Reuse Systems

Water reuse systems consist of structures that are designed to intercept and temporarily store stormwater runoff. These systems are beneficial because they capture stormwater runoff and allow it to be used for irrigation, which promotes infiltration of that stored water following a storm event. If a storage system does not contain a water reuse application, it does not qualify as a volume control practice since there is no infiltration.

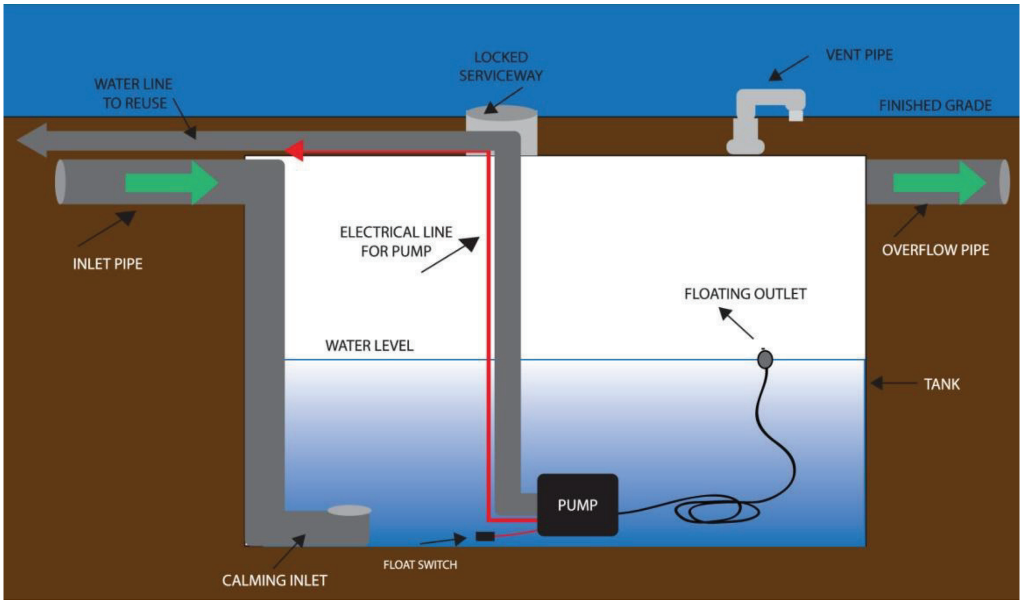


Figure 5.17. Typical Water Reuse System (Stormwatersmart.org, 2015)

Water reuse systems can either be above-ground or underground, and may be gravity-drained or pump-evacuated. A typical underground water reuse system is shown as Figure 5.17. There are several common variations of these systems available that include:

- Rain barrels
- Rain cisterns (above-ground and underground)
- Underground storage (tanks, vaults, or other manufactured products)

Design Considerations:

- Water reuse systems are commonly used to intercept and store stormwater runoff from rooftops, but can be designed with other areas such as parking lots.
- Placement of water reuse system in the up-gradient portions of a site may eliminate or reduce the need for pumping.
- An overflow pipe must be provided to bypass large storm events through the system.

- To ensure that the storage is available for the next storm event, the system should be designed so that it completely drains within 72 hours. If a low-flow pump is used to dewater the facility, an operation plan should be provided that follows this dewatering schedule.
- Overflow conditions should be considered when prescribing an offset from building foundations. The minimum setback for water reuse systems should be 10 feet from the nearest building foundation (unless waterproofed).
- Pretreatment measures for water reuse systems consist of screens and/or trash racks to filter debris from incoming stormwater runoff.

Green Roofs

A green roof is a conventional rooftop that includes a covering of vegetation which allows it to act like a pervious surface instead of an impervious one. There are two types of green roofs: intensive and extensive. Extensive green roofs involve a shallow growing medium layer (typically four inches or less) and therefore support plants with shallow root systems, such as herbs, grasses, moss, and sedum. Intensive green roofs include a deeper growing medium layer (typically between 4 and 12 inches) that can support plant species with deeper root zones, including trees and shrubs. Intensive green roof systems are generally limited to flat roofs and require significantly more maintenance than extensive green roof systems.

The overall thickness of a green roof may range anywhere from two inches to 12 inches, and consists of multiple layers that include: planting layer (native vegetation), growing medium layer, geotextile fabric, drainage layer, insulation, membrane protection and root barrier, and structural supports. An example cross-section of a green roof is provided as Figure 5.18 below.

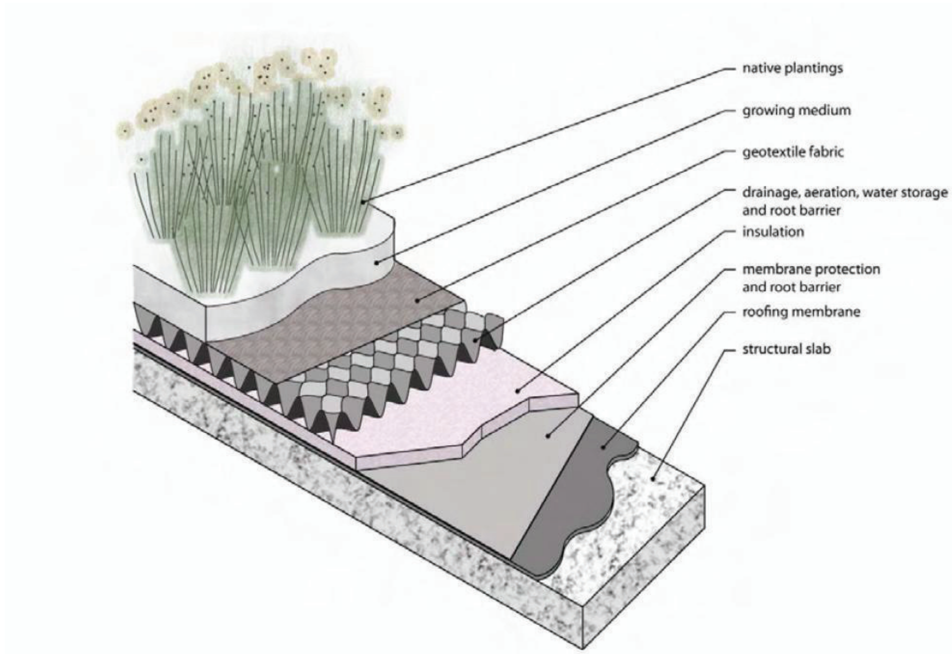


Figure 5.18. Typical Green Roof Cross-section (Source: City of Chicago, 2014).

Green roofs provide runoff storage volume in the void space of both the growing medium layer and the drainage layer. Therefore, the runoff volume reduction potential of a green roof is a function of the thickness of its growing medium and drainage layers. Table 5-9 provides a summary of the curve number and available volume control storage for a variety of media thicknesses. For calculating volume control storage, a void ratio of 0.25 should be used for the growth medium layer and also the drainage layer (typically pea gravel).

Table 5-9. Summary of Curve Numbers and Volume Control Storage for Green Roofs

Media Depth* (inches)	Void Ratio	Reduced CN	Reduced Runoff Coefficient, C	Volume Control Storage (ft^3/ft^2 of Green Roof)
0	---	98	0.90	---
2	0.25	94	0.83	0.042
4	0.25	90	0.74	0.083
6	0.25	85	0.66	0.125
9	0.25	79	0.54	0.188
12	0.25	72	0.40	0.25
>12	0.25	63	0.10	>0.25

*Media Depth includes growing medium layer and drainage layer

Design Considerations:

- Roofs with slopes greater than 45^{o} are typically not suitable for a green roof system.
- Careful attention and additional maintenance are necessary during the first two growing seasons to ensure establishment and proper function as a volume control system.

- Access should be considered for ease of inspection and maintenance.
- The load-bearing capacities of green roofs must be verified by a licensed structural engineer and architect (design plans must be sealed by either). Roof structure must be able to support snow loads in addition to green roof loading.
- A minimum setback of two feet is required from the roof perimeter and all roof penetrations (e.g. water connections, building parts for the usage of roof area, etc.)
- Growth media should consist of 80% lightweight inorganic materials and 20% organic matter.
- Native plants should be selected according to ASTM E2400-06, *Guide for Selection, Installation and Maintenance of Plant for Green (Vegetated) Roof Systems*.
- If vegetation consists of drought-resistant plants, irrigation is usually only necessary during the plant establishment period. Otherwise, an irrigation system is a typical component of a green roof system (water reuse system may be used for irrigation).
- Pretreatment measures are not required for green roof systems.

Filter Strip

Filter strips are vegetated sections of land that treat sheet flow from adjacent **impervious areas**. Filter strips are beneficial because they remove pollutants from **stormwater** before they reach the receiving **storm sewer** system. Filter strips may provide some reduction in **stormwater runoff** volume, but their primary function is to filter out contaminants in **stormwater runoff**. Since they do not provide any quantifiable storage, the use of filter strips is appropriate as a **flow-through practice** only.

Figure 5.19. Illustration of a Filter Strip

Design Considerations:

- Filter strips are suitable for draining areas that are five acres or less.
- The minimum length of the filter strip may be determined by the type of vegetative cover, permeability of the soil present, and slope of the filter strip. In general, filter strips should be no less than 30 feet in length and should not exceed 100 to 150 feet in length, as sheet flow will concentrate and cause **erosion**.
- Longitudinal slopes for filter strips should be between 2 and 5%, but can be up to 10%. The slope should be uniform throughout the strip to maintain sheet flow.
- Since concentrated flows entering a filter strip can cause **erosion**, a level spreader may be required at the top of the slope.

For additional design considerations, the **Illinois Urban Manual** practice standard is available on-line at: http://aiswcd.org/IUM/standards/urbst835.html.

Vegetated Swale

Vegetated swales are shallow earthen channels that are designed to slow **stormwater runoff** and promote infiltration. Similar to filter strips, vegetated swales intercept **stormwater runoff** from nearby **impervious areas**. Their primary function is to filter pollutants and **sediment** from **stormwater runoff**. Since they do not provide any quantifiable storage, the use of vegetated swales is appropriate as a **flow-through practice** only.

Vegetated swales may be combined with non-infiltration related storage volume to provide the required **volume control storage**. For example, an underground concrete vault (concrete bottom) may be used to provide the one inch of volume over the proposed **impervious area**. The vault may be pump-evacuated to a **flow-through practice** (such as a vegetated swale) to treat the volume. For configurations such as these, the storage volume component of volume control is provided in the vault, while the infiltration and pollutant removal component is provided in the **flow-through practice**. These facilities must be operated and maintained in a manner that maximizes the availability of the provided storage volume.

Figure 5.20. Typical Cross-section for Vegetated Swale

Design Considerations:

- Vegetated swales can be applied in most **development** situations with few restrictions. They are well-suited to treat highway or residential road **stormwater runoff** due to their linear nature.
- They must be sized and designed based on **drainage area**, soils, and the **volume control storage**.
- To maximize the wetted perimeter, side slopes of 4:1 or flatter are recommended. Side slopes should not exceed a 3:1 ratio.
- Longitudinal channel slopes should range from as close to zero as drainage permits to 4%. Slopes greater than 4% can be used if check **dams** are used to reduce flow velocity.
- Additional design details are available on-line at: http://www.stormwatercenter.net/.

Example 5.5 – Calculation of Required Volume Control

A five acre commercial area is proposed in a **combined sewer area** with the land use described below. The required volume control is to be provided by a permeable parking lot. The average surface elevation is at 636.0 feet and the **groundwater** elevation has been determined to be at 631.0 feet.

- Area of **building** = 2.3 acres
- Area of permeable parking lot = 1.5 acres
- Area of dry-bottom detention pond = 0.3 acres
- Landscaping = 0.9 acres

- Volume of voids in the stone below the permeable pavement is 36%
- Depth of permeable paver and settling base = 9 inches
- Infiltration rate of underlying soil = 0.3 inches/hour

The required **volume control storage**, V_c, is calculated as follows:

$$V_c = \quad 2.3 \text{ acres} \times \frac{43{,}560 \text{ ft}^2}{\text{acre}} \times 1'' \textbf{ runoff} \times \frac{\text{ft}}{12''} = 8{,}349 \text{ ft}^3$$

Note that the permeable pavement is not included in the **impervious area** calculation.

The first step is to calculate the volume that is provided in the 2-inch (minimum) offset between the bottom of the facility and the invert of the underdrain, over the 1.5-acre parking lot. The void space storage in this location is credited at 100%, and is calculated by the following:

$$2 \text{ inches} \times \frac{1 \text{ ft}}{12 \text{ inches}} \times 1.5 \text{ acre} \times \frac{43{,}560 \text{ ft}^2}{1 \text{ acre}} \times 0.36 = 3{,}920 \text{ ft}^3$$

Therefore, a storage volume of 4,429 ft^3 must be provided above the underdrain invert (8,349 ft^3 – 3,920 ft^3). Since the storage volume in this location is only credited at 50%, the required volume and depth of stone above the underdrain invert can be calculated by:

$$\frac{4{,}429 \text{ ft}^3}{0.36 \times 0.50} = 24{,}606 \text{ ft}^3 \times \frac{1}{1.5 \text{ acre}} \times \frac{1 \text{ acre}}{43{,}560 \text{ ft}^2} = 0.38 \text{ ft}$$

Since the required depth of stone is now known, the design can be checked against the site constraints and WMO requirements:

Depth to the bottom of stone:

636.0 ft – (9 in/12) – 0.38 ft – (2 in/12) = 634.70 ft

Depth from the bottom to **groundwater**:

634.70 ft – 631.0 ft = 3.70 ft → OK > 3.5 ft

See Figure 5.21 below for the configuration of the proposed permeable pavement parking lot, as determined in Example 5.5.

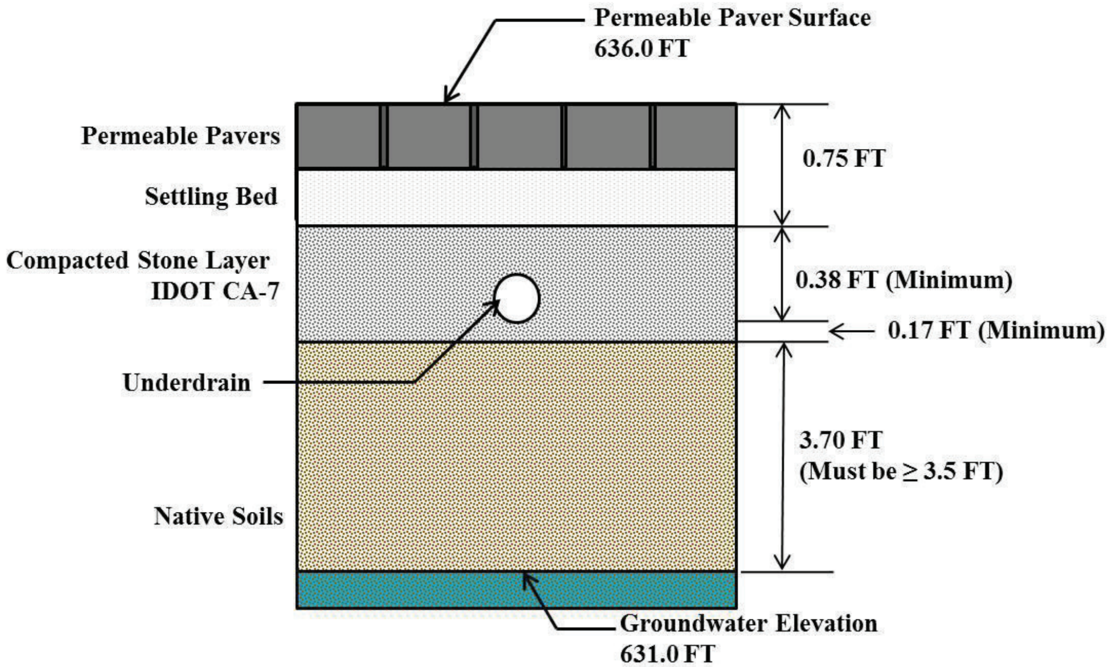


Figure 5.21. Configuration of Volume Control Storage for Example 5.5

While this design provides the required **volume control storage** and satisfies the WMO offset requirements for **groundwater**, there are several alternative designs that could also work. Since the void storage below the underdrain invert is credited at 100%, the offset from the bottom could be increased (instead of the minimum 2 inches) to provide more **volume control storage**. This would reduce the depth of stone needed above the underdrain invert. Alternatively, the depth of stone could also be reduced by expanding the area of the permeable pavement parking lot.

Other Design Requirements:

- Because the infiltration rate of the existing soils is less than 0.5 inches/hour, an underdrain must be provided for the storage. The underdrain must be offset a minimum height of 2 inches (0.17 feet), with a maximum allowable offset of 12 inches (1 foot) from the bottom.
- Because this example is located in a **combined sewer area**, the bottom of the volume control storage must be at least 3.5 feet above the seasonal **groundwater** elevation. In **separate sewer areas**, the requirement is 2 feet.
- The permeable pavement storage will need two monitoring wells (1 per 40,000 ft^2).
- In this example, the aggregate was assumed to be **IDOT** CA-7. Other aggregate sizes may be used for **volume control practices**, provided that it is crushed, angular stone that is cleaned and washed free of fines. Since the available void space will vary with aggregate size, extra care must be taken in the volume control storage calculations.

- The permeable pavement should be designed to slope towards a drainage **structure** such as an inlet so overflows can be captured. This **structure** can also be the **structure** that the underdrain connects to. Since the only **impervious area** not draining to the **volume control practice** is the roof area, no **flow-through practice** is required.

Table 5-10. Summary of Storage Calculations for Volume Control Practices

Volume Control Practice	Void Space of Aggregate[1]	Surface Storage[2]	Growing Media[3]
Bioretention Facility	X	X	X
Bioswale[4]	X	X	X
Constructed Wetlands	X	X	X
Drywell	X		
Green Roof	X		X
Infiltration Trench	X		
Permeable Pavement	X		
Storage Below Detention Basin Outlet		X	
Vegetated Filter Strip (Flow-Through)			
Water Reuse System		X	

[1]A void ratio of 0.36 shall be used to calculate volume in CA-1 or CA-7 gradations, 0.25 for pea gravel or CA-16 (volume above underdrain credited at 50%)

[2]Storage calculated using average-end method between surface elevation and elevation of overflow grate/check dam/outlet pipe

[3]Porosity of 0.25 shall be used to calculate volume in growing media (volume above underdrain credited at 50%)

[4]Surface storage only if check dams are installed

Table 5-11. Summary of Pretreatment Measures for Volume Control Practices

Volume Control Practice	Pretreatment Measures
Bioretention Facility	• Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. • Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the facility to filter out settleable particle and floatable materials. • Where inflow velocities are greater than 3 ft/s, a vegetated filter strip or rock outlet protection must be installed to prevent erosion and distribute flows across the facility. • Vegetated portions of the contributing drainage area must be stabilized.
Bioswale	• Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. • Vegetated portions of the contributing drainage area must be stabilized.
Constructed Wetlands	• Where inflow velocities are greater than 3 ft/s, rock outlet protection should be provided to prevent erosion and distribute the flows into the facility. • Vegetated portions of the contributing drainage area must be stabilized. • Sediment forebay shall be installed upstream of the facility.
Drywell	• Filter screens must be installed on all roof drains directed toward the facility. • For facilities that include inflow pipes, sump and/or trash rack shall be installed at manhole immediately upstream of facility.
Green Roof	• No pretreatment measures required.
Infiltration Trench	• Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. • Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the trench to filter out settleable particle and floatable materials. • Where inflow velocities are greater than 3 ft/s, a vegetated filter strip or rock outlet protection should be provided to prevent erosion and distribute flows across the facility. • Vegetated portions of the contributing drainage area must be stabilized.
Permeable Pavement	• Vegetated filter strip, grass-lined channel, or sump must be installed upstream of the facility to filter out settleable particle and floatable materials. • Vegetated portions of the contributing drainage area must be stabilized.
Storage Below Detention Basin Outlet	• Where inflow velocities are greater than 3 ft/s, rock outlet protection should be provided to prevent erosion and distribute the flows into the facility. • Vegetated portions of the contributing drainage area must be stabilized. • Sediment forebay shall be installed upstream of the facility.
Vegetated Filter Strip (Flow-Through)	• Level spreader must be installed where runoff enters the facility as shallow concentrated flow to distribute the runoff as sheet flow over the entire facility. • Vegetated portions of the contributing drainage area must be stabilized.
Water Reuse System	• Filter screens must be installed on all roof drains directed toward the facility. • For facilities that include inflow pipes, sump and/or trash rack shall be installed at manhole immediately upstream of facility.

Impervious Area Reduction for Redevelopment Sites

For **redevelopment sites**, where **volume control practices** are not feasible due to **site** limitations (contaminated soils, high **groundwater** table, close proximity to wells, etc.) a reduction in existing **impervious area** may be permitted. This strategy relies on several techniques to reduce the total area of rooftops, parking lots, streets, sidewalks and other types of impervious cover created at a **development site**. The basic approach is to reduce each type of impervious cover by downsizing the required minimum geometry specified in current local codes, keeping in mind that there are minimum requirements that must be met for fire, snowplow, and school bus operation. In many communities, local codes may need to be changed to allow the use of this group of better **site** design techniques.

The WMO (§503.3.C) states that for **redevelopments**, a proportionate reduction in existing **impervious area** is required for retention of any portion of the **volume control storage** that cannot be addressed using **volume control practices**. To utilize this provision, the applicant must:

1. Demonstrate that **site** limitations prevent the use of **volume control practices** to retain the **volume control storage** in full; and

2. Provide the **volume control storage** onsite to the maximum extent practicable.

For **developments** that satisfy the above requirements, for every 5% of **impervious area** that is reduced onsite, the **volume control storage** may be reduced by 25%. To satisfy the full **volume control storage** requirements, the **site's impervious area** would have to be reduced 20% from existing conditions.

Demonstration of Redevelopment Site Limitations

If the **redevelopment site** can retain a portion of the **volume control storage**, then **volume control practices** must be provided. For any portion of the **volume control storage** that cannot be retained on **site**, then soil data, **groundwater** data, and other **site** design limitations, such as zoning requirements, must be included in the **Watershed Management Permit** submittal. The information provided must demonstrate why a portion of the **volume control storage** cannot be retained and infiltrated or treated with a **flow-through practice**.

Volume Control Storage Credit for Volume Control Practices

As stated in the WMO (§503.3.C), the required **detention facility** volume can be reduced by the **volume control storage** provided onsite. To ensure that the **detention facility** and outlet control **structures** are appropriately sized for the 100-year, 24-hour **runoff** volume, the **volume control storage** credit is provided as a reduction in the overall curve number (CN) of the developed **site**. The following steps outline the CN reduction methodology:

For a given **watershed** (**site**) with area, A_W, **stormwater** storage is required using the **NRCS** procedure and is also required to provide a volume of infiltration storage equal to or greater than 1 inch over the **impervious area**, A_I, of the **development**. This procedure was developed to reflect the volumetric reduction in the **runoff** hydrograph for the **site** area (A_W).

The **NRCS runoff** equation is:

$$R_W = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where,

R_W = **runoff** depth (in) from Area, A_W
P = rainfall depth used to calculate **runoff** (in),
S = potential maximum retention after **runoff** begins (in), and is calculated by:

$$S = \frac{1000}{CN_W} - 10$$

Where,

CN_W = **runoff** curve number for the **watershed**

The volume of **runoff** (acre-feet), V_W, from **watershed** A_W can then be calculated by:

$$V_W = \frac{A_W}{12} \times R_W$$

The total volume of **runoff** from the **site** can be reduced by the volume control required and the extra **green infrastructure** volume that may be provided:

$$V_{ADJ} = V_W - V_R - V_{GI}$$

where,

V_{ADJ} = adjusted **runoff** volume from **site** (acre-feet)
V_R= volume of **volume control storage** (one-inch over **impervious area** of **development**)
V_{GI} = volume of **green infrastructure** provided in addition to the required one-inch

This reduced volume of **runoff** can be reflected in an overall reduction to the CN used in detention basin sizing by using:

$$\frac{V_{ADJ}}{A_W} = R_{ADJ} = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Since R_{ADJ} is known, and P = 7.58 inches for the 100-year, 24-hour **storm event**, we can solve for S, which then translates to the adjusted CN. The adjusted curve number (CN_{ADJ}) is then used to calculate the required detention volume for the **site**.

Example 5.6 – Calculation of Volume Control Storage Credit (CN Reduction)

For a 10-acre proposed residential area with a developed CN of 78, and 3 acres of **impervious area**, find the revised CN resulting from the one-inch volume control provisions of the WMO.

The future 100-year **runoff** volume for the proposed **development** without volume control can be calculated using the **NRCS runoff** equation.

$$R_W = \frac{(7.58\text{ in}-0.2S)^2}{(7.58+0.8S)}$$

$$S = \frac{1000}{78} - 10 = 2.82\text{ in}$$

$$R_W = \frac{(7.58\text{ in} - (0.2)(2.82\text{ in}))^2}{7.58\text{ in} + 0.8(2.82\text{ in})}$$

$$Rw = 5.00\text{ inches}$$

The total volume is therefore:

$$V_W = \frac{R_W}{12} \times \quad A_W = \frac{5}{12} \times 10\text{ acres} \quad = 4.17\text{ acre-feet}$$

The volume associated with the total **impervious area** that must be stored is:

$$V_R = \quad 3\text{ acres} \quad \times \frac{1\text{ in}}{12} = 0.25\text{ acre feet}$$

For this example, V_{GI} =0, so the adjusted **runoff** volume is:

$$V_{ADJ} = 4.17\text{ acre-feet} - 0.25\text{ acre feet} = 3.92\text{ acre-feet}$$

And therefore:

$$12 \times \frac{V_{ADJ}}{A_W} = \frac{(P - 0.2S)^2}{(P + 0.8S)} = 4.70\text{ in}$$

Since P=7.58 inches:

$$4.70 \text{ inches} = \frac{(7.58 \text{ in} - 0.2S)^2}{(7.58 \text{ in} + 0.8S)}$$

Solving this equation iteratively:

S = 3.28, and the adjusted CN, CN_{ADJ} = 75.32

The curve number in this example is reduced from 78 to 75.32. This procedure reflects the **stormwater** volume reduction and allows for hydrologic routing through proposed **stormwater** management facilities. To simplify this procedure, an Excel spreadsheet has been provided which reflects the analysis described above. The applicant would only have to provide areas, developed CN and the depth of storage being provided and the reduced CN would be solved for the user. The spreadsheet version of Example 5.6 is shown below.

RUNOFF CURVE NUMBER ADJUSTMENT CALCULATOR

Site Information:

Total Site Area, A_w (ac) =	10	**Total Impervious Area, A_I (ac) =**	3
Runoff, R (in) =	5.00		
P = rainfall depth (in) =	7.58		
CN =	78		
S =	2.82		
Runoff Volume Over Watershed, V_w (ac-ft) =	**4.17**		

Volume of GI Provided:

Volume Control Storage, V_R =	**0.25**	ac-ft	1" of volume over impervious area
Additional Volume, V_{GI} =	**0.00**	ac-ft	Additional volume over the required 1"

Adjusted Volume Over Watershed, $V_{ADJ} = V_W - V_R - V_{GI}$

V_{ADJ} (ac-ft) =	**3.92**

Adjusted Runoff Over Watershed, $R_{ADJ} = \frac{V_{ADJ}}{A_W}$

R_{ADJ} (in) =	**4.70**
S_{ADJ} =	**3.28**
Adjusted CN for detention calcs, CN_{ADJ} =	**75.32**

*Blue values are entered by user

Volume control facilities that make use of void volume above the invert of an underdrain (and which is reduced by 50%), may take full credit for this void volume toward required detention (at 100%), provided the void volume is tributary to the restrictor.

SITE DETENTION REQUIREMENTS (§504)

As presented in §504.1 of the WMO, **site detention facilities** are required for:

1. "**Residential subdivision development** on **parcels** totaling five acres or more" in size;

2. **Non-residential** or **multi-family residential development** on **parcels** totaling three acres or more in size "with new **development** on the **parcel**(s) that totals either individually or in the aggregate to more than 0.5 acres after the effective date" of the WMO; and

3. Roadway **development** that creates more than one acre of **new impervious area**, where practicable.

Non-residential developments (including those **developments** that have been made exempt from the WMO) will be required to provide **site** detention volume when new **development** to the **site** (any activity or disturbance that affects **runoff**, including the grading of pervious to pervious, or the replacement of impervious on impervious) reaches 0.5 acres in aggregate since the effective date of the WMO. The provision allows existing **non-residential developments** to expand or construct additions before having to provide detention storage.

Allowable Release Rate

The **allowable release rate** for a **development site** that discharges to a **waterway** is (§504.3):

- 0.30 cfs per acre of **development** for the 100-year event.

The calculation of the **allowable release rate** is based on the area of **development** (§504.2). The **allowable release rate** is the maximum allowable **stormwater** discharge release rate for the entire **development site**. Though the **site detention facility** release rate may be impacted by the presence of existing **depressional storage** or **unrestricted flow** within the **development**, the **site** maximum **allowable release rate** is 0.30 cfs per acre. §504.4 states that the release rate from the **site detention facility** plus the flowrate from any **unrestricted flow** areas must not exceed the **allowable release rate** for the **development**.

Allowable release rate *for the 100-year event:*

$$Q_{Allowable\_(100\text{-}year)}\ (\text{cfs}) = 0.30\ \text{cfs/acre} \times A_{Development}\ (\text{acres})$$

Where: $Q_{Allowable\_(100\text{-}year)}$ = the **allowable release rate** for the 100-year event in cubic feet per second (cfs)

$A_{Development}$ = the area of the **site development** (acres)

Existing Depressional Storage

§504.5 requires that the **allowable release rate** be reduced to reflect the retention provided in existing **depressional storage** areas. For **sites** where **depressional storage** exists and where the existing **runoff** rate for the **development** is less than the **allowable release rate** provided in §504.3, the **allowable release rate** must be reduced to the existing 100-year **runoff** rate for the **development**. The required detention volume for the **site** must be calculated using the existing **runoff** rate for the **development site**. The existing **runoff** rate must in turn be calculated using event hydrograph methods that account for the existing onsite **depressional storage** volume.

Unrestricted Flows

Unrestricted flow is **stormwater runoff** from a **development** which is not directed to the **detention facility**. This is commonly due to the location of the **site stormwater facility** or sometimes due to topography. The areas generating **unrestricted flow** are referred to as unrestricted or uncontrolled release rate areas.

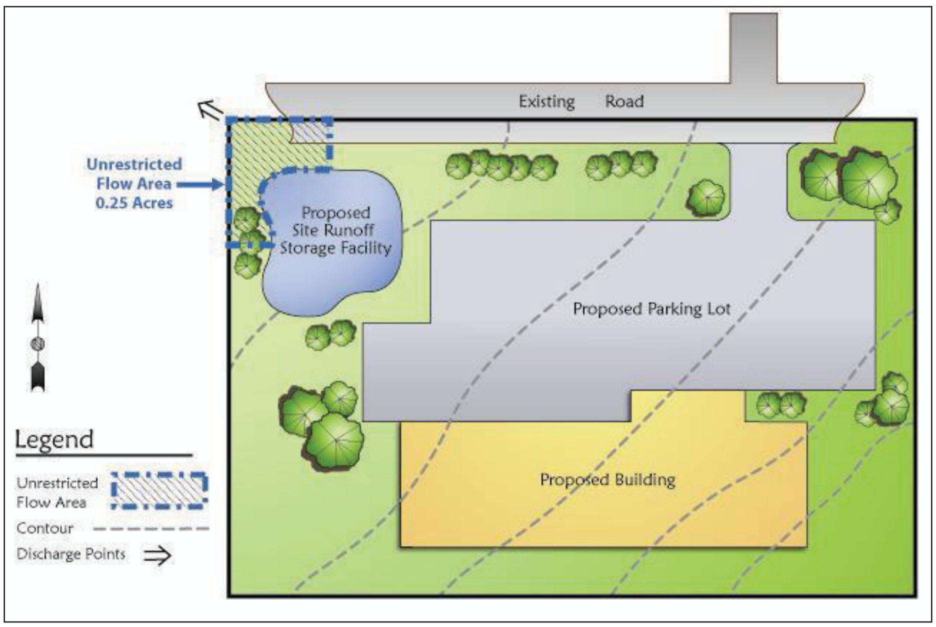


Figure 5.22. Unrestricted Flow Area on the Downstream Side of a Proposed Site Detention Facility

Every attempt should be made to direct all **runoff** from the **development site** to the **site detention facility**. Per §504.6, when all **runoff** from a **development** cannot be captured and conveyed to the **site detention facility**, the **unrestricted flow** must be addressed by demonstrating that it does not cause offsite damage. In addition, one of the following methods must be used:

Option 1 – Equivalent Area

Diverting an equivalent upstream **tributary area** where detention is not provided to the **site detention facility** is one option of addressing the **unrestricted flow**. If the **site** has **upstream tributary flows**, this flow can be diverted into the storage basin. Essentially, if **upstream**

tributary flow were to be bypassed through the **site**, a portion of this flow could be directed to the **site detention facility**. The **site allowable release rate** would remain the same as calculated in §504.3. CN values and time of concentration calculations would include the equivalent upstream **tributary area**. It should be noted that the diversion of equivalent area is only allowed if the property is owned by the applicant. Also, this is not a viable option if there is no offsite area tributary to the project **site**.

Option 2 – Reduction in Release Rate

Reducing the **allowable release rate** for the area that is tributary to the **site detention facility** to compensate for **unrestricted flow** leaving the **site** is another option of addressing this **unrestricted flow**. The **site allowable release rate** would remain as calculated in §504.3, but the **site detention facility** release rate is reduced.

An event hydrograph model run is needed to determine the release rate of the unrestricted area(s). Both the CN and the t_c must be calculated. The CN and the t_c must be specific to the unrestricted area.

Option 3 – Native Planting Conservation Area

Planting the **unrestricted flow** area with native deep-rooted vegetation approved by the **District** is the third option of addressing the **unrestricted flow**. **Unrestricted flow** areas must be placed in an easement and maintained as a **native planting conservation area** in perpetuity. The **allowable release rate** for the **development** must be based on the **development** area tributary to the **site detention facility**.

The **native planting conservation area** within a **development** must be planted and maintained with deep rooted native plants. The proposed plant mix and a landscape plan must be submitted with the **Watershed Management Permit** application. With Option 3, the **site allowable release rate** is re-calculated based on the area of the **development** minus the **unrestricted flow** area. The **site detention facility** release rate would become the **site allowable release rate**.

Site Detention Volume Determination

The **site** detention volume must be sufficient such that the 100-year **allowable release rate** specified in §504.3, or the reduced **allowable release rate** as required in §504.5 (**depressional storage**) and/or §504.6 (**unrestricted flow**), will not be exceeded.

The **site detention facility** volume must be calculated using either an event hydrograph routing method or the nomograph relating percent impervious to required detention volume.

<u>Event Hydrograph Method</u>

The event hydrograph method must be used when:

1. The **allowable release rate** calculated in §504.3 is adjusted due to **site depressional storage**;

2. The **allowable release rate** calculated in §504.3 is adjusted through Option 2 (§504.6.B(2)) or Option 3 (§504.6.B(3)) due to **unrestricted flow**;

3. There is **upstream tributary flow** to the **site** (§504.10); and/or

4. There are tailwater conditions on the **site detention facility** outlet **structure**.

The **site detention facility** must be sized such that the 100-year, 24-hour **storm event** release rate will not exceed the **allowable release rate** and the design high water level will be contained within the **site detention facility**. The event hydrograph methodology contained in the *Site Runoff Requirements* section of the **TGM** should be followed.

Detention Volume Nomograph

For simple cases, a detention volume nomograph can be used to determine the required detention volume for the **development**. The nomograph relates detention volume with the reduced CN of a **site** (the overall CN adjusted for the **volume control** storage provided), and is used instead of an event hydrograph method. The detention nomograph is provided as Figure 5.23.

The use of the nomograph is only allowable for the following scenarios:

- The **allowable release rate** is not affected by existing onsite **depressional storage**.
- The **allowable release rate** is not affected by any **unrestricted flow**.
- There is no **upstream tributary flow** to the proposed **detention facility**.
- There are no tailwater conditions on the proposed **detention facility's** outlet control **structure**.

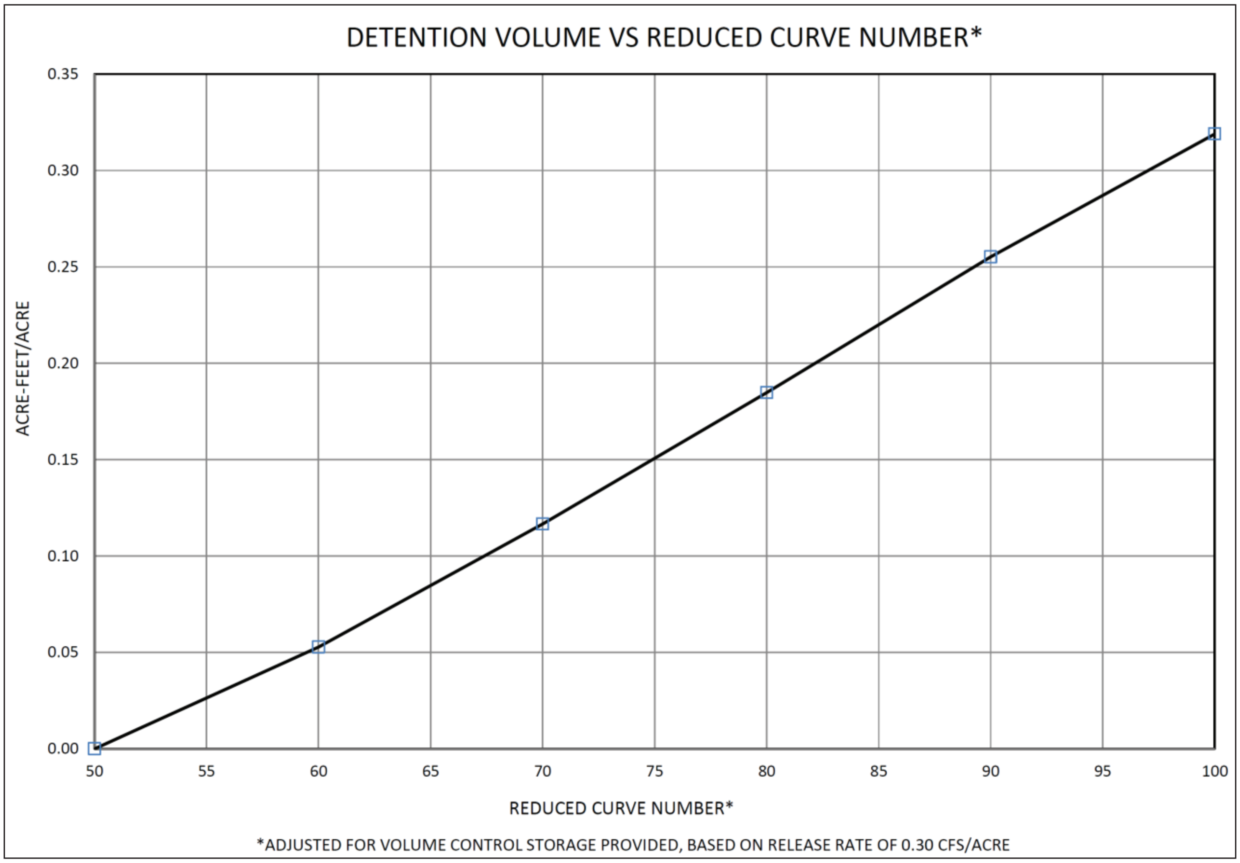


Figure 5.23. Detention Nomograph

Upstream Tributary Flow

Upstream tributary flow includes **stormwater runoff** or **groundwater** flows from **tributary areas** upstream of a **development site**. The WMO (§504.10) requires that the proposed **site detention facility** be designed to safely convey any upstream flow through the project **site**. Flows from the upstream **tributary areas** to the **site** should be computed under fully developed conditions to ensure the proposed **stormwater facilities** are not undersized. Upstream offsite flows cannot be blocked.

When an **upstream tributary flow** to a **development site** exists, it must be addressed in conjunction with the design of the **site detention facility** by one of the following options:

Option 1 – Bypass Flow

Provide **site detention facility** volume for the **development** at the **allowable release rate** while bypassing **upstream tributary flows** either (1) around the **site** to the existing discharge location or (2) through the proposed **detention facility**. The preferred method is to bypass offsite flows around the **site**. The bypass flow can be routed around the **development** via **storm sewer** or swales and must be designed to convey the 100-year critical duration **storm event**. If it is not feasible to route offsite flows around the **site**, the bypass flow may be routed through the proposed **detention facility**, with the overflow weir/restrictor sized to convey the onsite and offsite 100-year critical duration peak flowrate. In either case, the bypass flow must not result in an increase in velocities or flows when leaving the proposed **development site** downstream or on adjacent properties. The applicant is responsible for demonstrating that any downstream or adjacent drainage conditions are not exacerbated when compared with pre-development conditions.

The method for bypassing upstream flows through the **site** should be based on the following hierarchy:

1. Where possible, the preferred method is to bypass flows around the **site**. Offsite flows may be routed through the **detention facility** if the **drainage areas** meet the requirements of (2) below. If the ratio of offsite to onsite **drainage area** is greater than 5:1, the upstream flow must be bypassed around the **detention facility**.

2. If the ratio of offsite to onsite **drainage area** is 5:1 or less, the 100-year critical duration peak flowrate from upstream areas should be bypassed through the overflow weir of the **detention facility**.

Whenever offsite flows are routed through the **detention facility**, an analysis of the basin drawdown time must be performed. In cases where the drawdown time is excessive (greater than 72 hours), it is recommended that the upstream **tributary area** is bypassed around the **detention facility**.

Option 2 – Routing Through Site Detention facility

Provide **site detention facility** volume to accommodate both the **runoff** for the **development** and the **upstream tributary flow** area on the **site** at the **site's allowable release rate**. If it is infeasible to route the **upstream tributary flows** around the **site**, this alternative would be to route the offsite flows into the **site detention facility** while providing additional storage volume for the offsite flow. The **site detention facility** volume will be determined based on the **allowable release rate** (calculated from the **site** area excluding the upstream **tributary area**) and the **stormwater runoff** from the **site** area and the upstream **tributary area** for the 100-year, 24-hour storm.

Option 3 – Store the Upstream Tributary Flow

Sufficient **site detention facility** volume can be provided to accommodate **runoff** from the **development** and **the upstream tributary flow** area with a release rate that ensures that no adverse offsite impacts will occur and that a **water resource benefit** is provided. The applicant must consider **runoff** from all **tributary areas** and demonstrate the impacts for 2-year, 10-year, and 100-year **storm events**, at a minimum, using **critical duration analysis** and the methodology provided in §504.9. The minimum **site detention facility** volume required must be based on the **site allowable release rate** as determined in §504.3 and §504.4. The **District** or **authorized municipality** will determine whether the proposed release rate is sufficiently providing a **water resource benefit**.

Design Considerations for the Site Detention Facility

Site detention facilities may be dry-bottom or wet-bottom basin designs. The treatment of the **volume control storage** may be addressed within the basin design. The design of the outlet **structure** and emergency overflow, and the consideration of tailwater conditions are of particular concern, and are discussed below. Numerous other design considerations must also be made. §504.11 requires that the **site detention facility** must:

1. Be designed to provide one foot of freeboard (an elevation higher than the **base flood** water level) for the 100-yr, 24-hr storm;

2. Be designed to function with a gravity outlet wherever possible;

3. Function without human intervention and under tailwater conditions with minimal **maintenance**;

4. Provide an overflow **structure** and overflow path that can safely pass a **design runoff rate** of at least 1.0 cfs/acre of **tributary area** to the **site detention facility**;

5. Provide side slope **stabilization**;

6. Provide earth **stabilization** and armoring with riprap, concrete or other durable material when high erosive forces could lead to soil **erosion** or washout. Examples of where armoring may be required include:

    a. **Storm sewer** flared end sections;

    b. Emergency Overflows; and

    c. Berms adjacent to streams.

7. Be accessible and maintainable; and

8. Provide a **maintenance** agreement.

Other design considerations include:

1. Above-ground **site detention facilities** should provide access for **maintenance** like riding lawn mowers or a small truck;

2. **Site detention facilities** with retaining walls, a ramp will need to be provided for the above mentioned equipment access;

3. Above-ground **site detention facilities** should be designed with side slopes of 4-feet horizontal to 1-foot vertical (4:1) for ease of maintenance. The design minimum for side slopes is 3-feet horizontal to 1-foot vertical (3:1);

4. Underground facilities should also provide access for **maintenance** through manholes large enough for the necessary **maintenance** to be performed, including access ladders. Access is recommended near all storm sewer outlets and inlets to the underground detention system to allow for ease of inspection, maintenance, and debris removal. A minimum of two access points is recommended at opposite ends of the vault for safety, with a minimum of at least one ladder provided egress (e.g. located along a wall with integrated steps).

5. Appurtenance rim elevations for **stormwater facilities** upstream and downstream of the **site detention facility** must be higher than the **base flood** level of the **site detention facility**; and

6. When feasible the **site detention facilities** should be constructed and functioning prior to issuance of **building** permits or the operation of **sanitary sewers** for service. Volume control facilities that make use of void volume above the invert of an underdrain (and which have been reduced by 50%), may take full credit for this void volume toward required detention (at 100%), provided the void volume is tributary to the restrictor.

7. Volume control facilities that make use of void volume above the invert of an underdrain (and which have been reduced by 50%), may take full credit for this void volume toward required detention (at 100%), provided the void volume is tributary to the restrictor.

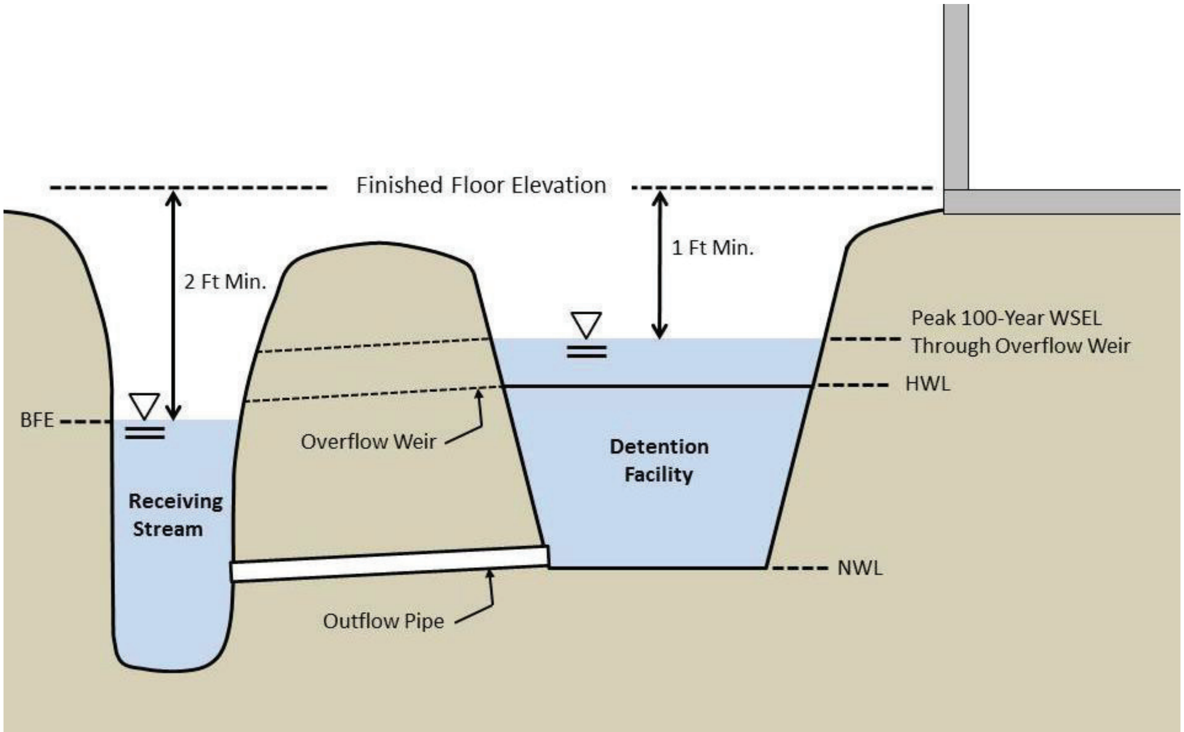


Figure 5.24. Critical Elevations for Detention Facilities

As shown in Figure 5.24, the finished floor elevation (or low-entry elevation) for proposed **structures** must be at least one foot above the peak 100-year water surface elevation (WSEL) through the overflow weir. The overflow weir will typically be set at the HWL of the detention basin and sized to convey the peak 100-year onsite and offsite flowrate. The depth of flow in the overflow weir is the peak 100-year WSEL for the **detention facility**, and one foot of freeboard must be provided for adjacent **structures** above this elevation.

Tailwater/Zero Release Rate Conditions

Tailwater conditions occur when a **stormwater facility** discharges to a **floodplain**, depressional area, a poor draining swale, **storm sewers**, or a condition where the HGL for the downstream condition is higher than the outlet of the **site stormwater** management facility.

When tailwater conditions are present, the **allowable release rate** for the **site detention facility** is 0 cfs (zero release rate) until the water level in the facility (the head) exceeds the tailwater elevation. This prevents negative impacts to the downstream condition, as there will be no discharge until the facility outlet can drain. Tailwater conditions may require an increase in the size of the **site detention facility**. The outlet control **structure** should be sized assuming no tailwater conditions, but the volume in the **detention facility** should be determined by the appropriate tailwater conditions. The **site detention facility** may not exceed the **allowable release rate** when the **detention facility** is modeled without tailwater conditions.

Determining the tailwater condition depends upon the type of downstream facility. If the storage facility is discharging into a river or **floodplain**, the **100-year flood elevation** is used as the tailwater condition. If the storage facility is discharging into a depressional area, drainage swale, or **storm sewer** system the applicant should use the highest elevation (**base flood**) as the tailwater elevation. The local governing body may determine that the tailwater elevation may need to be raised or lowered based on local conditions.

Site Detention facility Outlet Structure

The outlet **structure** of the **site detention facility** (restrictor) should be sized using the orifice equation such that the **allowable release rate** is met at the design high water level (HWL) of the **detention facility**. The orifice equation consists of the following:

$$Q = C \times A \times (2gh)^{0.5}$$

Where,
Q = discharge rate, in cfs
C = orifice discharge coefficient (taken from Figure 5.23)
A = orifice area (ft^2)
g = acceleration due to gravity, 32.2 ft/s^2
h = head (ft); vertical distance between water surface and center of orifice

The appropriate orifice discharge coefficient, C, should be used based on the restrictor type shown in Figure 5.25. In addition, the head on the orifice should account for any tailwater effects from receiving streams, if applicable.

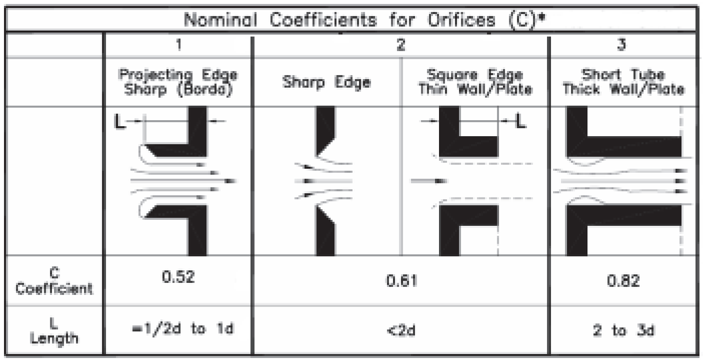


Figure 5.25. Orifice Discharge Coefficients (Source: MWRD, 1978)

The outlet control device for **site detention facilities** must meet the following design requirements:

1. The outflow control restrictor (including the emergency overflow device) must be located within the property boundary;

2. The location of the outflow control restrictor must be clearly shown on a utility **site** plan drawing and a section detail must be provided; installation must be permanent and durable; there must be no plastic or removable or adjustable gates or systems, or bypass shunts/secondary outlets;

3. The outflow control restrictor must be visible and readily accessible for **maintenance** (cleaning/rodding) and inspection;

4. Outflow control restrictors must be located on the downstream side of the **structure** for ease of debris clearing;

5. The outflow control restrictor must be designed to be self-cleaning;

6. Restrictor plates must be of minimum ¼ inch thickness, and shaped to conform to the concrete **structure** wall, with a minimum of four steel anchor bolts screwed with epoxy at least three inches into the wall, with all bolt heads tack welded to the plate;

7. Restrictor pipes must be inserted in larger diameter pipes; the restrictor pipe must be a minimum 2-foot long with the annular space over the length filled with non-shrink grout suitable for submergence;

8. The outflow control restrictor must have a minimum 4-foot diameter manhole or **structure** of equivalent clearance; and

9. Though there is no minimum restrictor size (diameter), **maintenance** increases with smaller diameters. It is recommended that whenever possible, head be reduced; or if there are multiple onsite restrictors, the **site detention facilities** should be combined to

facilitate increasing the restrictor size (where appropriate). If a project entails any restrictor with less than a 4-inch diameter, a letter from the applicant is required acknowledging a more stringent outlet **maintenance** plan, and a letter from the **permittee** is required acknowledging enforcement of the **maintenance** plan. Restrictors less than 4 inches in diameter should be installed with hoods and in a wall with a pre-sump. Another acceptable alternative for restrictors less than four inches in diameter is the use of the City of Chicago's vortex restrictor.

The preferred outlet control structure consists of a center-wall style restrictor configured with a removable hood that prevents debris from clogging the restrictor. Example details for these devices are provided in Appendix C.

Emergency Overflow Structure

The WMO (§504.11.C) requires an overflow **structure** and overflow path for the **site runoff** facility that can safely pass a **design runoff rate** of at least 1.0 cfs per acre of **tributary area**. The **design runoff rate** must be determined in accordance with the methodology for **major stormwater system**s. A properly sized overflow **structure** and overflow path will help protect the **detention facility** from damage should the water level in the facility exceed the one foot of freeboard and direct the overflow downstream to an appropriate location. The overflow **structure** may be set at the high water elevation of the facility but all other elevations surrounding the facility will need to be constructed at least one foot above the high water level in the emergency overflow **structure**. The capacity of the emergency overflow **structure** and overflow path for the **site detention facility** shall be designed by calculating the 100-year critical duration peak onsite and offsite flowrate to the **detention facility**. The design flowrate should be based on the 100-year critical duration flowrate, or 1.0 cfs/acre of **tributary area**, whichever is higher.

$$Q_{Overflow}\text{ (cfs)} = 1.0\text{ cfs/acre} \times A_{Tributary}\text{ (acres)}$$

Where: $Q_{Overflow}$ is the minimum overflow **structure** capacity
$A_{Tributary}$ is all of the area tributary to the **site detention facility**, including the **development site** and **upstream tributary flow** directed to the **site detention facility**

The overflow weir for the **site detention facility** should be sized using the weir equation:

$$Q = C \times L \times H^{3/2}$$

Where,
Q = flowrate (cfs)
C = weir coefficient (assume = 3.0)
L = length of weir (ft)
H = head on weir (ft)

The following examples provide sample calculations for the sizing and design of a **detention facility** for several scenarios that range from simple to complex.

Example 5.7 – Simple Detention (Nomograph Method)

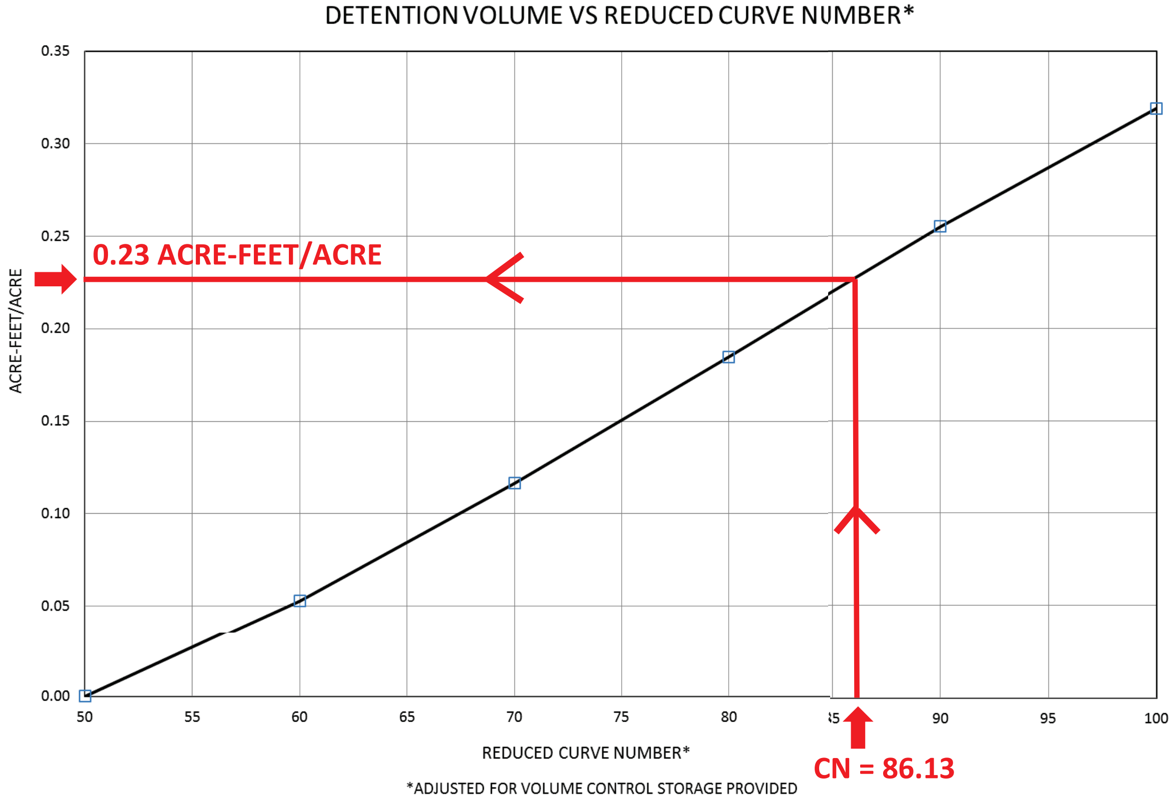
Using the **site** from *Example 5.2*, determine the required detention volume using the detention nomograph. It is assumed that the proposed **site** will provide the required volume control storage in the aggregate voids under the permeable pavement parking lot. It is also assumed there is no offsite **tributary area** or **unrestricted flow** area for the **site**.

As shown in Example 5.2, the curve number for the **site** is 89, with a total **impervious area** (open water and **building**) of one acre. The required volume control storage, V_C, for the **site** is calculated as:

$$V_c = \quad 1 \text{ in x } \frac{1 \text{ foot}}{12 \text{ inches}} \text{ x 1 acre } = \quad 0.083 \text{ acre-feet}$$

Using the CN Adjustment Calculator for the **site** (shown below), the adjusted CN is calculated to be 86.13.

RUNOFF CURVE NUMBER ADJUSTMENT CALCULATOR					
Site Information:					
Total Site Area, A_W (ac) =	3		**Total Impervious Area, A_I (ac) =**		1
Runoff, R (in) =	6.28				
P = rainfall depth (in) =	7.58				
CN =	89				
S =	1.24				
Runoff Volume Over Watershed, V_W (ac-ft) =	**1.57**				
Volume of GI Provided:					
Control Volume, V_R =	**0.08**	**ac-ft**	1" of volume over impervious area		
Additional Volume, V_{GI} =	**0.00**	**ac-ft**	Additional volume over the required 1"		
Adjusted Volume Over Watershed, $V_{ADJ} = V_W - V_R - V_{GI}$					
V_{ADJ} (ac-ft) =	**1.49**				
Adjusted Runoff Over Watershed, $R_{ADJ} = \frac{V_{ADJ}}{A_W}$					
R_{ADJ} (in) =	**5.94**				
S_{ADJ} =	**1.61**				
Adjusted CN for detention calcs, CN_{ADJ} =	**86.13**				
*Blue values are entered by user					



Using the detention nomograph, 0.23 acre-feet of detention volume is required for every acre of **development**, based on the adjusted CN of 86.13. By multiplying this value times the **development** area of 3 acres, the required detention volume is calculated to be 0.69 acre-feet.
It should be noted that although the detention nomograph is allowed to determine the required detention volume, an event hydrograph method must be used to size the overland flow routes in and out of the **detention facility**.

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

Name of Project: Example 5.7

A. DEVELOPMENT INFORMATION

1) Total parcel area: 3.0 acres
2) Total development area on the parcel: 3.0 acres

B. SITE VOLUME CONTROL REQUIREMENTS

1) Existing impervious area of development: 0.25 acres
2) Proposed impervious area of development: 1.00 acres
3) Gross volume control storage required (0.083 X Line B.2): 0.08 acre-feet
4) Volume control storage allowance. Do site constraints prevent the use of retention-based practices in full? ☐ Yes ☑ No
   If yes, explain and complete B.4.a, B.4.b, and B.4.c ______
   a. Percent reduction in impervious area (B.1 – B.2)/B.1: ______%
   b. Volume control storage allowance (Line B.4.a/5%)(0.25)(Line B.3): ______acre-feet
   c. Volume control treated by a flow through practice: ______acre-feet
5) Net volume control storage required (Line B.3 – Line B.4.b – Line B.4.c): 0.08 acre-feet
6) Volume control storage provided (must be greater than line B.5) : 0.08 acre-feet

C. SITE DETENTION REQUIREMENTS

1) Type of stormwater detention facility (check one)

☑ Reservoir
☐ Parking Lot
☐ Offsite Facility
Location______
☐ Other
Specify______

2) Release Rate Determination
   A) Existing conditions 100-year runoff rate for the development: N/A cfs
   (if the development contains depressional storage)
   B) Gross allowable release rate: 0.90 cfs
   (lesser of Line C.2.A or 0.30 x Line A.2)
   C) Unrestricted release rate: 0.00 cfs
   (assume 0 cfs if equivalent upstream area is being diverted to the detention facility)
   D) Unrestricted native planting area
      i. Area: N/A acres
      ii. Reduction in release rate: N/A cfs (0.30 x Line C.2.D.i)

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 1 OF 3

Schedule D Form for Example 5.7 (Page 1 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

E) Net allowable release rate: 0.9 cfs
(Line C.2.B – Line C.2.C - Line C.2.D.ii)

3) Detention Volume Determination
(Submit calculations for items C.3.A through C.3.H)

a. Methodology
- ■ Nomograph
- ☐ Hydrologic model (select modeling software and indicate version)
  - ☐ HEC-HMS ______
  - ☐ TR-20 ______
  - ☐ WIN TR-20 ______

b. Composite CN for the development: 89
c. Reduced CN for the development: 86.13
d. Time of concentration for the development: 15 minutes
e. Required detention volume at actual release rate: 0.69 acre-feet
f. Actual detention volume provided at HWL: 0.69 acre-feet
g. Actual release rate: 0.9 cfs at HWL 700.00 ft (NAVD 88)
(cannot be greater than Line C.2.E)
h. Outlet control structure (provide details and calculations)
   i. Orifice
      1. Type: Sharp-edge
      2. Discharge coefficient: 0.61
      3. Diameter: 4.14 in
      4. Orifice invert elevation 696.00 ft (NAVD 88)
   ii. Weir
      1. Weir length: 5.0 ft
      2. Weir invert elevation: 700.00 ft (NAVD 88)

D. UPSTREAM TRIBUTARY AREA

1) Upstream tributary drainage area: 0.00 acres
A) Ratio of upstream tributary area to development area: N/A
B) Composite CN for upstream tributary area: N/A
C) Time of concentration for upstream tributary area: N/A minutes
D) 100-year peak flowrate for upstream tributary area: N/A cfs
E) Detention facility drawdown time: N/A hours

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 2 OF 3

Schedule D Form for Example 5.7 (Page 2 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

2) Describe bypass system type details: ☐ Overflow weir ☐ Restrictor

Orifice diameter: N/A in Orifice invert elevation: N/A ft (NAVD 88)

Orifice type and discharge coefficient: N/A

Weir length: N/A ft Weir invert elevation: N/A ft (NAVD 88)

Name John Smith Title Project Engineer

Signature ________ Date 4/28/14

Engineering Firm Smith Engineering

PE SEAL

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 3 OF 3

Schedule D Form for Example 5.7 (Page 3 of 3)

Example 5.8 –Detention with Unrestricted Releases and Upstream Tributary Area

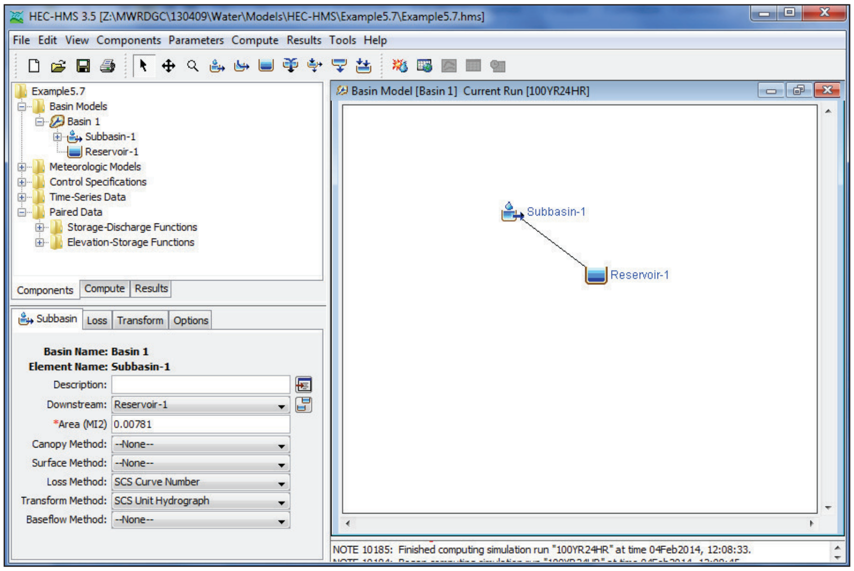
A proposed 5-acre commercial **development** has a curve number (CN) of 93 (80% impervious) and a time of concentration (t_c) of 15 minutes. Determine the **stormwater** detention volume required for the **site**. Based on **Cook County** one-foot topography, it was determined there are 3 acres of offsite **tributary area** to the project **site**. The offsite **tributary area** has a CN of 89 and a t_c of 12 minutes. The proposed **development** will provide the 1 inch of **volume control storage** in the void space of aggregate under a permeable parking lot. There is a 0.2-acre area with a CN of 74 and a t_c of 10 minutes that will release undetained from the **site**.

Step 1: Using the ***Runoff** Curve Number Adjustment Calculator* spreadsheet, determine the reduced curve number resulting from the 1 inch of **volume control storage** provided for the **site**.

RUNOFF CURVE NUMBER ADJUSTMENT CALCULATOR					
Site Information:					
Total Site Area, A_w (ac) =	5			**Total Impervious Area, A_I (ac) =**	4
Runoff, R (in) =	6.75				
P = rainfall depth (in) =	7.58				
CN =	93				
S =	0.75				
Runoff Volume Over Watershed, V_w (ac-ft) =	**2.81**				
Volume of GI Provided:					
Control Volume, V_R =	**0.33**	ac-ft	1" of volume over impervious area		
Additional Volume, V_{GI} =	**0.00**	ac-ft	Additional volume over the required 1"		
Adjusted Volume Over Watershed, $V_{ADJ} = V_W - V_R - V_{GI}$					
V_{ADJ} (ac-ft) =	**2.48**				
Adjusted Runoff Over Watershed, $R_{ADJ} = \frac{V_{ADJ}}{A_W}$					
R_{ADJ} (in) =	**5.95**				
S_{ADJ} =	**1.60**				
Adjusted CN for detention calcs, CN_{ADJ} =	**86.22**				
*Blue values are entered by user					

As shown in the above figure, a CN of 86.22 should be used in the **stormwater** detention calculations.

Step 2: Using the adjusted CN for the proposed **development** determined in Step 1, set up a HEC-HMS hydrologic model to determine the required **stormwater** detention volume.



In this case, there is one subbasin that represents the project **site** (Subbasin-1) and one storage area that represents the proposed detention pond (Reservoir-1). The subbasin and pond are the components of the *Basin Model*.

The *Meteorological Model* contains the rainfall depth information, which is the 100-year, 24-hour from Table 5-3 (7.58 inches). The *Time-Series Data* contains the time distribution of rainfall, which is the Huff 3rd quartile distribution for the 24-hour storm duration.

For *Subbasin-1*, enter the information for the project **site**:

- Area = 0.00781 square miles (5 acres)
- CN = 86.22 (from CN adjustment calculator spreadsheet) (do not enter % impervious)
- Lag time = 9 minutes (0.6 * t_c)
- SCS CN and Unit Hydrograph Methodology

The stage-storage-discharge relationship for the detention basin is specified under Paired Data. For *Reservoir-1*, a spreadsheet is used to determine the stage-storage-discharge relationship for the proposed **detention facility**.

Step 3: Determine the **allowable release rate** for the **site**, accounting for any unrestricted areas. The **allowable release rate** from the **site** is initially 1.5 cfs (0.3 cfs/acre x 5 acres) but should be adjusted to account for the 0.2-acre undetained area (which was delineated based on the proposed grading plan). The 100-year, 24-hour unrestricted release rate from this area must be calculated using the HEC-HMS hydrologic model. Information for the unrestricted area is provided below:

- $Area_{unrest}$ = 0.00031 square miles (0.2 acres)
- CN = 74
- Lag time = 6 minutes (0.6 * t_c = 10 minutes)

A new subbasin (*Undetained*) must be added to the HEC-HMS model. As shown in the next HEC-HMS screenshot, the undetained area is not routed to the proposed **detention facility**. From the HEC-HMS model, the 100-year, 24-hour unrestricted release rate from the **site** is **0.12 cfs**. The **allowable release rate** for the **site** must be adjusted for the unrestricted release rate by the following:

Maximum **allowable release rate** – unrestricted release rate = net **allowable release rate**,

The net **allowable release rate** = 1.50 cfs – 0.12 cfs = 1.38 cfs

It is assumed that there is no tailwater condition for the **site**. Based on the **site** conditions, it was determined that five feet of depth is possible in the proposed detention basin.

Step 4: Use the orifice equation spreadsheet to size the restrictor. Using the elevation-discharge spreadsheet, a 4.9-inch diameter restrictor is needed to pass the net **allowable release rate** of 1.38 cfs at the HWL of 605 ft.

PROPOSED CONDITIONS
ORIFICE/WEIR STRUCTURE RATING ANALYSIS

PROJECT NAME:	Technical Guidance Manual
PROJ. NO.:	13-0409
DESCRIPTION:	Example 5.7
FILENAME:	Orifice.xlsx
DATE:	9-Feb-14

OUTLET:	ORIFICE #1:	4.86	IN. DIA. @ ELEV	600
	ORIFICE #2:	N/A	IN. DIA. @ ELEV	N/A
	WEIR #1:	N/A	FEET WIDE @ ELEV	N/A
	WEIR #2:	N/A	FEET WIDE @ ELEV	N/A

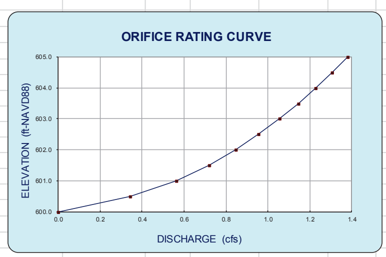
HYDRAULIC DIMENSIONS

	# 1	#2
ORIFICE AREA (ft^2)	0.1288	
ORIFICE DIAMETER (in)	4.9	
ORIFICE DISCHARGE COEFFICIENT	0.61	
ORIFICE ELEV. (ft-NAVD88)	600.00	
TAILWATER OR CENTROID (ft-NAVD88)	600.20	
WEIR LENGTH (ft)		
WEIR COEFFICIENT		
WEIR ELEV. (ft-NGVD)		

ORIFICE FLOW EQUATION: $Q = 0.6A(2gH)^{0.5}$
WEIR FLOW EQUATION: $Q = 3.0L(H)^{1.5}$

ELEVATION-DISCHARGE RELATIONSHIP

Elevation (feet)	Q-orifice #1 (cfs)	Q-orifice #2 (cfs)	Q-weir #1 (cfs)	Q-weir #2 (cfs)	Q-total (cfs)
600.0	0.00	0.00	0.00	0.00	0.00
600.5	0.34	0.00	0.00	0.00	0.34
601.0	0.56	0.00	0.00	0.00	0.56
601.5	0.72	0.00	0.00	0.00	0.72
602.0	0.85	0.00	0.00	0.00	0.85
602.5	0.96	0.00	0.00	0.00	0.96
603.0	1.05	0.00	0.00	0.00	1.05
603.5	1.15	0.00	0.00	0.00	1.15
604.0	1.23	0.00	0.00	0.00	1.23
604.5	1.31	0.00	0.00	0.00	1.31
605.0	1.38	0.00	0.00	0.00	1.38

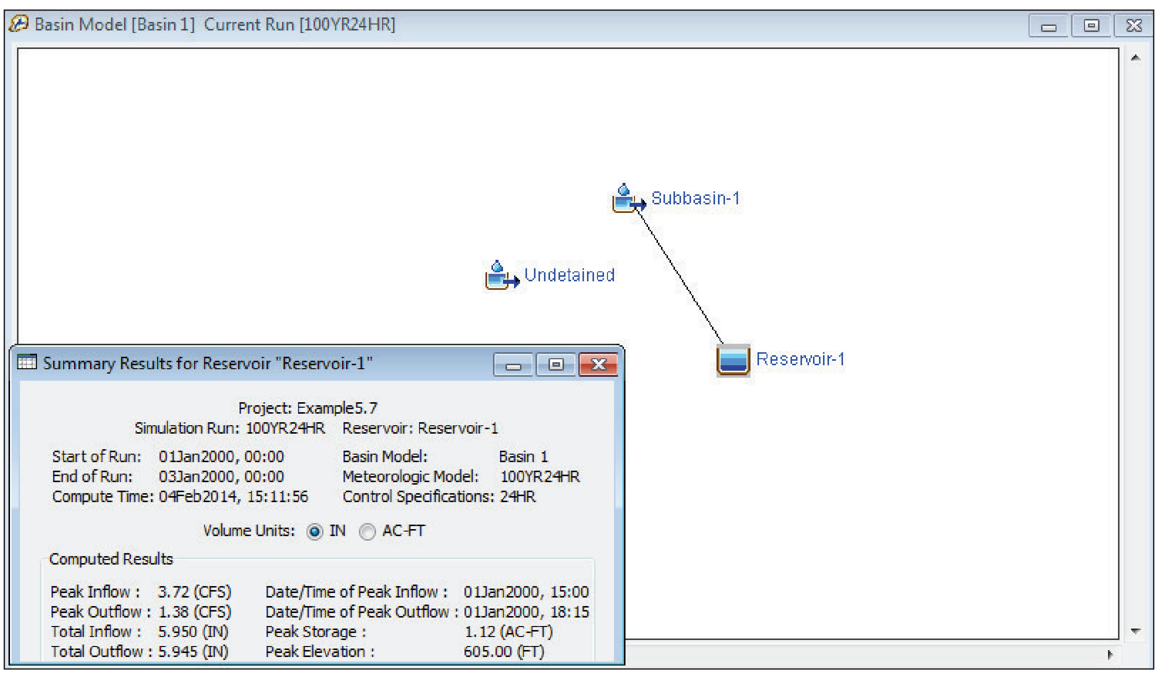


Step 5: Use the elevation-storage spreadsheet to obtain the appropriate relationship to enter into HEC-HMS. For each iteration, the HEC-HMS stage-storage relationship must be revised under *Paired Data* to match the iterated spreadsheet below.

POND:	Proposed Detention Facility		Centerline Elevation	
JOB NO.	130409	Side Slopes	Orifice Radius:	
PROJECT:	Example 5.7	1	Orifice Coeff:	
FILE:	Storage.xls	4	Weir Elevation:	
DATE:	2/4/2014		Length of Weir	
DA			Weir Coeff	

Elevation (ft)	INC	Area (ft2)	Area (ac)	Average Area (ac)	Incremental Storage (ac-ft)	Cummulative Storage (ac-ft)
600.00		6,080	0.140			
				0.155	0.15	
601.00		7,392	0.170			0.155
				0.186	0.19	
602.00		8,831	0.203			0.341
				0.221	0.22	
603.00		10,399	0.239			0.562
				0.258	0.26	
604.00		12,094	0.278			0.820
				0.299	0.30	
605.00		13,918	0.320			1.118

Using the elevation-storage spreadsheet, iteratively enter the elevation-storage relationship until the proposed basin fills up for the 100-year, 24-hour **storm event**. As shown in the figure below, a volume of 1.12 acre-feet is required for this **site**.



From the results of the HEC-HMS analysis for the 100-year, 24-hour **storm event**, the HWL of the proposed **detention facility** is 605.00 ft.

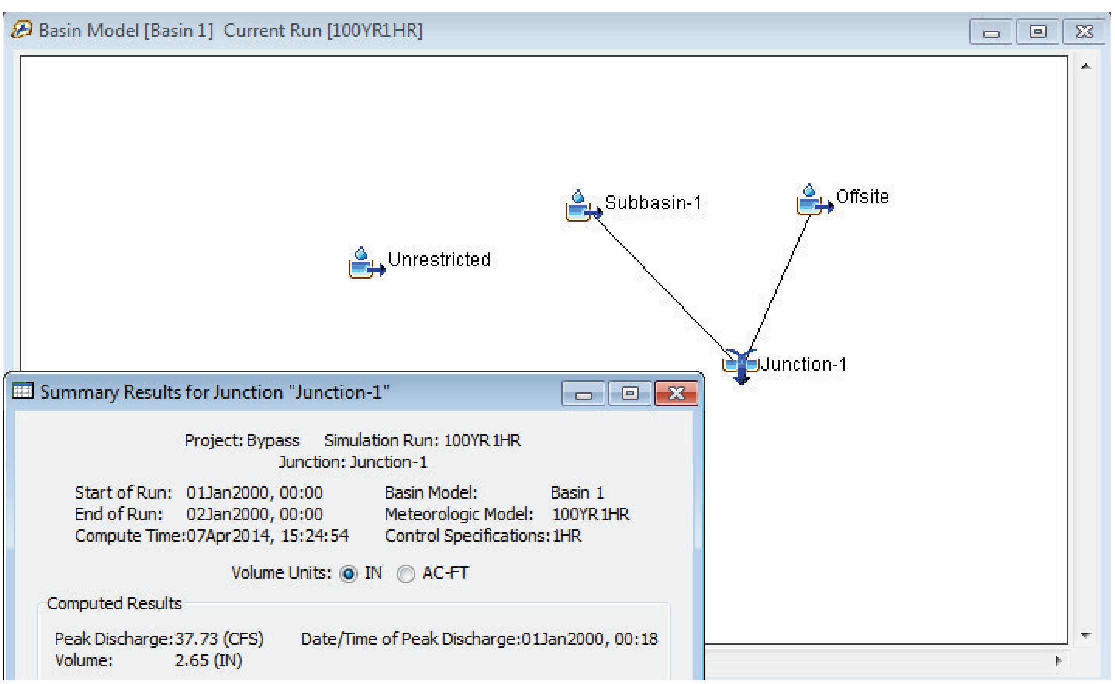
Step 6: Determine the 100-year peak flowrate from offsite and onsite **tributary areas** to the **detention facility**. An emergency overflow weir is needed to safely pass offsite flows, and onsite flows in the event the restrictor becomes blocked. Information for the offsite area is provided below:

- Offsite area = 0.00469 square miles (3.0 acres)
- CN = 89
- Lag time = 7.2 minutes (0.6 * t_c = 12 minutes)

A new subbasin (*Offsite*) is required to determine the peak flowrate of the offsite **tributary area** to the **detention facility** and a *junction (Junction-1)* is required to add the **runoff** hydrographs from the onsite and offsite **tributary areas**. In determining the design flowrate, the unadjusted CN for the **site** should be used. The reduced CN is to be used only for the determination of required detention volume; all other **stormwater** design should be based on the composite CN for the **site**.

A **critical duration analysis** must be run for the offsite plus the onsite **tributary area** to determine the 100-year peak flowrate. The overflow weir must, at a minimum, be sized for 1.0 cfs/acre of **tributary area**, so a check must be done following the HEC-HMS **critical duration analysis**. The results of the HEC-HMS analysis show that the 1-hour is the critical duration, with a peak flowrate of 37.7 cfs.

37.7 cfs = 4.7 cfs/acre > 1 cfs/acre → OK



Step 7: Size the overflow weir so that it can safely pass the 100-year critical duration flowrate from all onsite and offsite **tributary area**.

Using the weir equation,

$$Q = C \times L \times H^{3/2}$$

Where,
Q = flowrate (31.0 cfs)
C = weir coefficient (assume 3.0)
L = length of weir (ft)
H = head on weir (ft, assume 1 ft)

The weir equation becomes: $Q = 37.7 \text{ cfs} = 3.0 \times L \times (1)^{3/2}$, and solving for L,

L = 12.6 ft, which is the minimum length of weir required to pass the 100-year peak flowrate (with one foot of head) for the onsite and offsite area. In traditional detention basins, the emergency overflow weir is a trapezoidal or rectangular channel set at the HWL of the **detention facility**. It is also acceptable to provide the emergency overflow weir as a wall at the outlet control **structure** (within the manhole). The top of the wall is set to the HWL of the **detention facility**. Details for both types of overflow **structures** are provided in Appendix C. In either case, it must be demonstrated that the emergency overflow weir can safely pass the peak 100-year flowrate for the total **tributary area** (offsite and onsite) coming to the **detention facility**.

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

Name of Project: Example 5.8

A. DEVELOPMENT INFORMATION

1) Total parcel area: 5.0 acres
2) Total development area on the parcel: 5.0 acres

B. SITE VOLUME CONTROL REQUIREMENTS

1) Existing impervious area of development: 0.50 acres
2) Proposed impervious area of development: 4.00 acres
3) Gross volume control storage required (0.083 X Line B.2): 0.33 acre-feet
4) Volume control storage allowance. Do site constraints prevent the use of retention-based practices in full? ☐ Yes ☑ No
   If yes, explain and complete B.4.a, B.4.b, and B.4.c ____________
   a. Percent reduction in impervious area (B.1 – B.2)/B.1: ____________%
   b. Volume control storage allowance (Line B.4.a/5%)(0.25)(Line B.3): ____________acre-feet
   c. Volume control treated by a flow through practice: ____________acre-feet
5) Net volume control storage required (Line B.3 – Line B.4.b – Line B.4.c): 0.33 acre-feet
6) Volume control storage provided (must be greater than line B.5) : 0.33 acre-feet

C. SITE DETENTION REQUIREMENTS

1) Type of stormwater detention facility (check one)

   ☑ Reservoir
   ☐ Parking Lot
   ☐ Offsite Facility
   Location____________
   ☐ Other
   Specify____________

2) Release Rate Determination
   A) Existing conditions 100-year runoff rate for the development: N/A cfs
   (if the development contains depressional storage)
   B) Gross allowable release rate: 1.50 cfs
   (lesser of Line C.2.A or 0.30 x Line A.2)
   C) Unrestricted release rate: 0.12 cfs
   (assume 0 cfs if equivalent upstream area is being diverted to the detention facility)
   D) Unrestricted native planting area
      i. Area: N/A acres
      ii. Reduction in release rate: N/A cfs (0.30 x Line C.2.D.i)

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 1 OF 3

Schedule D Form for Example 5.8 (Page 1 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

E) Net allowable release rate: 1.38 cfs
(Line C.2.B – Line C.2.C - Line C.2.D.ii)

3) Detention Volume Determination
(Submit calculations for items C.3.A through C.3.H)

a. Methodology
- ☐ Nomograph
- ■ Hydrologic model (select modeling software and indicate version)
  - ■ HEC-HMS Version 4.0
  - ☐ TR-20 ______
  - ☐ WIN TR-20 ______

b. Composite CN for the development: 93
c. Reduced CN for the development: 86.22
d. Time of concentration for the development: 15 minutes
e. Required detention volume at actual release rate: 1.12 acre-feet
f. Actual detention volume provided at HWL: 1.12 acre-feet
g. Actual release rate: 1.38 cfs at HWL 605.00 ft (NAVD 88)
(cannot be greater than Line C.2.E)
h. Outlet control structure (provide details and calculations)
  i. Orifice
    1. Type: Sharp-edge
    2. Discharge coefficient: 0.61
    3. Diameter: 4.86 in
    4. Orifice invert elevation 600.00 ft (NAVD 88)
  ii. Weir
    1. Weir length: 12.6 ft
    2. Weir invert elevation: 605.00 ft (NAVD 88)

D. UPSTREAM TRIBUTARY AREA

1) Upstream tributary drainage area: 3.00 acres
A) Ratio of upstream tributary area to development area: 0.6
B) Composite CN for upstream tributary area: 89
C) Time of concentration for upstream tributary area: 12 minutes
D) 100-year peak flowrate for upstream tributary area: 37.7 cfs
E) Detention facility drawdown time: 36 hours

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 2 OF 3

Schedule D Form for Example 5.8 (Page 2 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

2) Describe bypass system type details: ☒ Overflow weir ☐ Restrictor

Orifice diameter: N/A in Orifice invert elevation: N/A ft (NAVD 88)

Orifice type and discharge coefficient: N/A

Weir length: 12.6 ft Weir invert elevation: 605.00 ft (NAVD 88)

Name John Smith Title Project Engineer

Signature ______ Date 4/28/14

Engineering Firm Smith Engineering

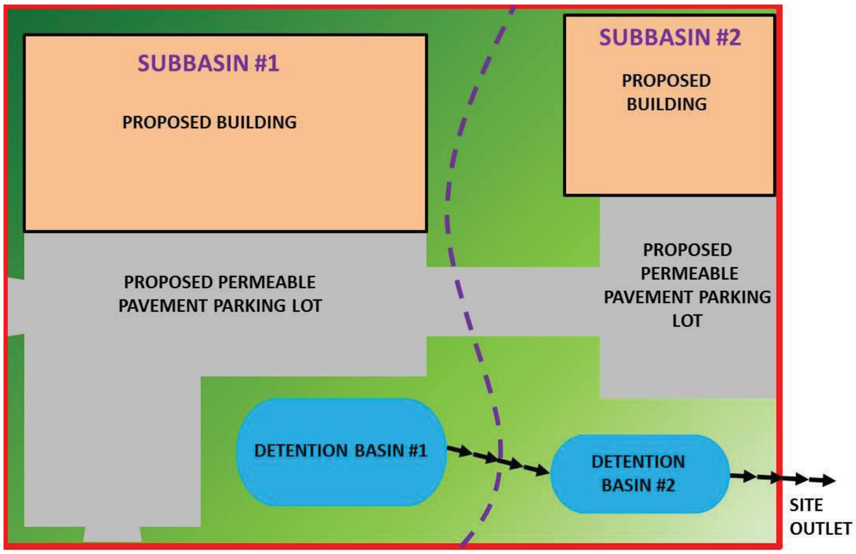
PE SEAL

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 3 OF 3

Schedule D Form for Example 5.8 (Page 3 of 3)

Example 5.9 – Detention Ponds in Series with Tailwater

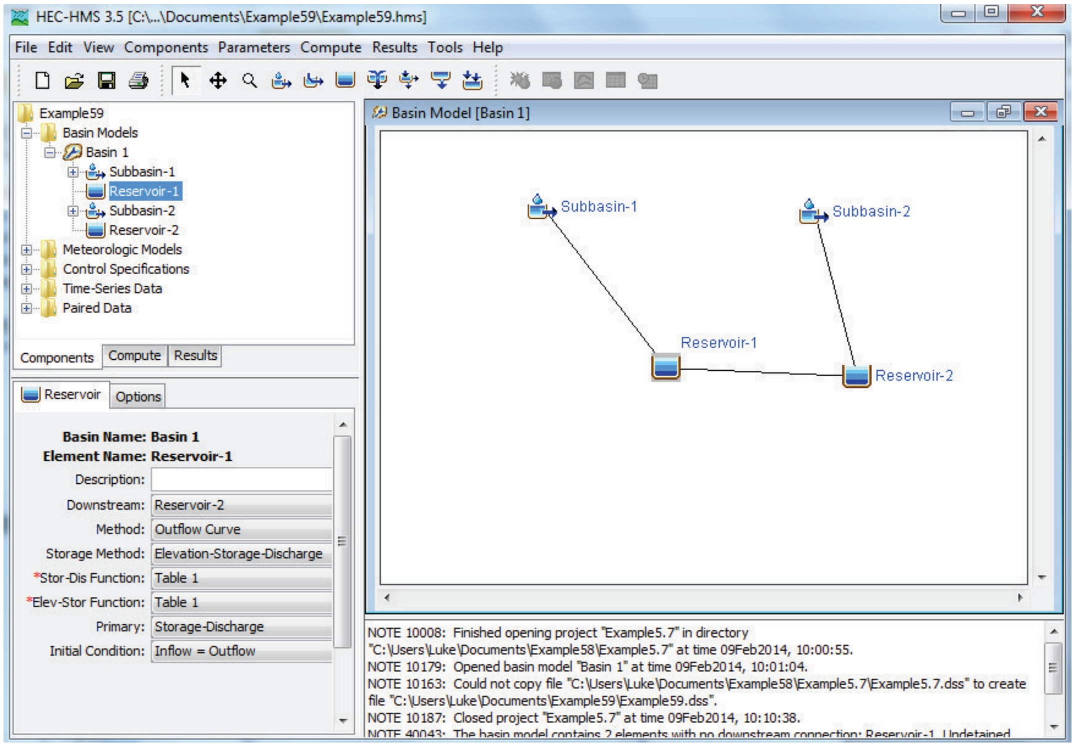
As shown in the figure below, the required detention volume for a proposed 10-acre commercial **development** will be provided in two detention basins in series. Based on **Cook County** one-foot topography, there is no offsite **tributary area** to the project **site**. However, Detention Basin 2 will discharge to a receiving stream with a **100-year flood elevation** of 699 feet. Based on the proposed grading plan, the **site** is separated into two subbasins. Determine the requirements of the two detention basins based on the WMO and **TGM**.



Subbasin 1
Area = 0.009375 square miles (6 acres)
Impervious Area = 2.25 acres
Curve Number = 92
Adjusted Curve Number = 88.79 (assumes 1 inch on volume control storage)
SCS Lag Time = 9 minutes

Subbasin 2
Area = 0.00625 square miles (4 acres)
Impervious Area = 1.25 acres
Curve Number = 88
Adjusted Curve Number = 85.36 (assumes 1 inch on volume control storage)
SCS Lag Time = 6 minutes

Step 1: Determine the required storage volumes for each of the proposed detention basins. A HEC-HMS model must be developed for the onsite area that will be detained. As shown in the next HEC-HMS screenshot, Subbasin-1 drains to Reservoir-1, and the outflow of Reservoir-1 then drains into Reservoir-2, along with Subbasin-2.



It is assumed there are no unrestricted areas for the proposed **development**. Therefore, the **allowable release rate** for the **site** is simply determined by 0.30 cfs/acre times the acreage. It should be noted that as long as the release rate at the **site's** outlet (Reservoir-2 outflow) is less than or equal to 3 cfs (0.30 cfs/acre x 10 acres), the proposed detention configuration is flexible. For example, if **site** conditions prevent Reservoir-1 from detaining Subbasin-1 at 0.30 cfs/acre, Reservoir-1 can be sized to underdetain its **tributary area**, so long as Reservoir-2 is oversized to meet the **allowable release rate** for the **site**.

From the proposed grading plan, it is determined that four feet of bounce can be accommodated in the proposed detention basins. The elevations of the **site** allow the following configurations of the detention basins:

<u>Detention Basin 1 (Reservoir-1)</u>
Normal Water Level (NWL) = 700 ft
High Water Level (HWL) = 704 ft
Tailwater Condition = none

<u>Detention Basin 2 (Reservoir-2)</u>
Normal Water Level (NWL) = 698 ft
High Water Level (HWL) = 702 ft
Tailwater Condition = 699 ft (**100-year flood elevation** of receiving stream)

Step 2: Using the orifice equation, determine the restrictor size for the proposed detention basins. Since the outflow of the restrictor for Reservoir-2 must be less than or equal to 3.0 cfs, the configuration of the detention basins is flexible as long as the ultimate outflow of the **site** meets this release. The restrictor for Reservoir-1 can release 1.8 cfs at the HWL of 704 ft and the restrictor for Reservoir-2 can release 3.0 cfs at the HWL of 702 ft. From the orifice equation spreadsheet (shown below), a 5.9-inch diameter restrictor is needed to convey 1.8 cfs at the HWL of 704 ft.

PROPOSED CONDITIONS
ORIFICE/WEIR STRUCTURE RATING ANALYSIS

PROJECT NAME:	Example 5.9
PROJ. NO.:	13-0409
DESCRIPTION:	Detention Basin 1
FILENAME:	Orifice.xlsx
DATE:	9-Feb-14

OUTLET:	ORIFICE #1:	5.9	IN. DIA. @ ELEV	700
	ORIFICE #2:	N/A	IN. DIA. @ ELEV	N/A
	WEIR #1:	N/A	FEET WIDE @ ELEV	N/A
	WEIR #2:	N/A	FEET WIDE @ ELEV	N/A

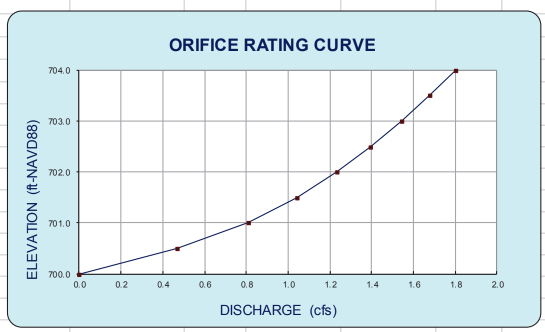
HYDRAULIC DIMENSIONS

	# 1	#2
ORIFICE AREA (ft^2)	0.1899	
ORIFICE DIAMETER (in)	5.9	
ORIFICE DISCHARGE COEFFICIENT	0.61	
ORIFICE ELEV. (ft-NAVD88)	700.00	
TAILWATER OR CENTROID (ft-NAVD88)	700.25	
WEIR LENGTH (ft)		
WEIR COEFFICIENT		
WEIR ELEV. (ft-NGVD)		

ORIFICE FLOW EQUATION: $Q = 0.6A(2gH)^{0.5}$
WEIR FLOW EQUATION: $Q = 3.0L(H)^{1.5}$

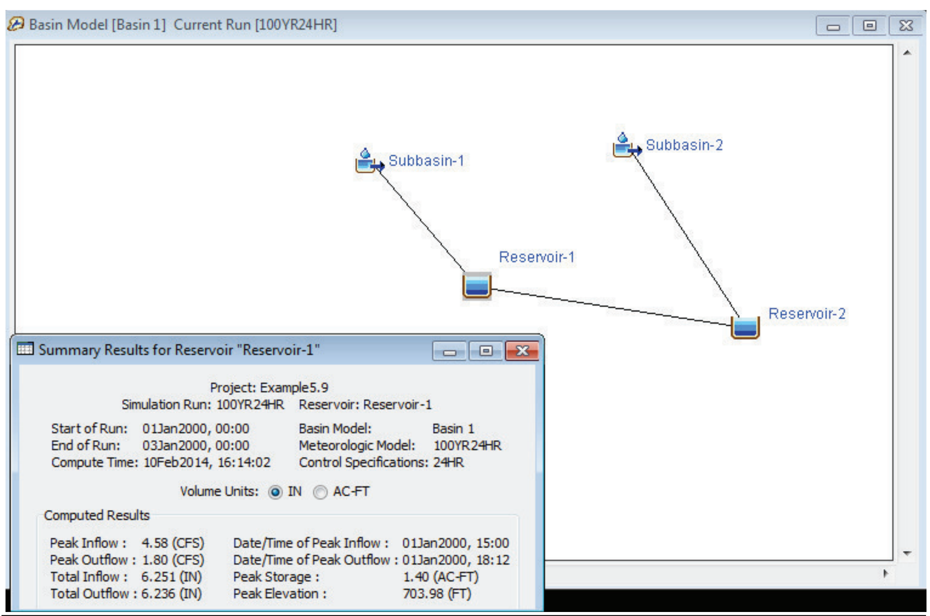
ELEVATION-DISCHARGE RELATIONSHIP

Elevation (feet)	Q-orifice #1 (cfs)	Q-orifice #2 (cfs)	Q-weir #1 (cfs)	Q-weir #2 (cfs)	Q-total (cfs)
700.0	0.00	0.00	0.00	0.00	0.00
700.5	0.47	0.00	0.00	0.00	0.47
701.0	0.81	0.00	0.00	0.00	0.81
701.5	1.04	0.00	0.00	0.00	1.04
702.0	1.23	0.00	0.00	0.00	1.23
702.5	1.40	0.00	0.00	0.00	1.40
703.0	1.54	0.00	0.00	0.00	1.54
703.5	1.68	0.00	0.00	0.00	1.68
704.0	1.80	0.00	0.00	0.00	1.80



Step 3: Using the elevation-storage spreadsheet and solving iteratively, it is determined that 1.40 acre-feet of storage volume is required for Detention Basin 1, as shown in the next HEC-HMS screenshot. For each iteration, the HEC-HMS stage-storage relationship must be revised under *Paired Data* to match the iterated spreadsheet below.

POND:	Proposed Detention Facility 1			Centerline Elevation		
JOB NO.		130409		Side Slopes	Orifice Radius:	
PROJECT:		Example 5.9		1	Orifice Coeff:	
FILE:		Storage.xls		4	Weir Elevation:	
DATE:		2/10/2014			Length of Weir	
DA					Weir Coeff	
		Area		Average	Incremental	Cummulative
Elevation	INC			Area	Storage	Storage
(ft)	0.25	(ft2)	(ac)	(ac)	(ac-ft)	(ac-ft)
700.00		11,543	0.265			
				0.285	0.29	
701.00		13,326	0.306			0.285
				0.328	0.33	
702.00		15,237	0.350			0.613
				0.373	0.37	
703.00		17,276	0.397			0.987
				0.421	0.42	
704.00		19,443	0.446			1.408



Step 4: Size the restrictor for Detention Basin 2 so that it releases 3.0 cfs at the HWL assuming full release conditions. As shown below, a 7.7-inch diameter restrictor is needed to convey the **allowable release rate**. However, since there is a tailwater condition on this restrictor, the detention volume must be sized assuming the 100-year tailwater of the receiving stream (699 ft). Therefore, another stage-discharge spreadsheet needs to be developed to determine the outflow assuming the 100-year tailwater of 699 ft.

PROPOSED CONDITIONS
ORIFICE/WEIR STRUCTURE RATING ANALYSIS

PROJECT NAME:	Example 5.9
PROJ. NO.:	13-0409
DESCRIPTION:	Detention Basin 2
FILENAME:	Orifice.xlsx
DATE:	9-Feb-14

OUTLET:

ORIFICE #1:	7.65	IN. DIA. @ ELEV	698
ORIFICE #2:	N/A	IN. DIA. @ ELEV	N/A
WEIR #1:	N/A	FEET WIDE @ ELEV	N/A
WEIR #2:	N/A	FEET WIDE @ ELEV	N/A

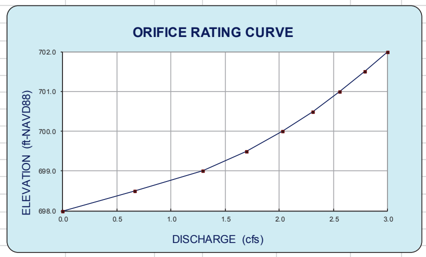
HYDRAULIC DIMENSIONS

	# 1	#2
ORIFICE AREA (ft^2)	0.3192	
ORIFICE DIAMETER (in)	7.7	
ORIFICE DISCHARGE COEFFICIENT	0.61	
ORIFICE ELEV. (ft-NAVD88)	698.00	
TAILWATER OR CENTROID (ft-NAVD88)	698.32	
WEIR LENGTH (ft)		
WEIR COEFFICIENT		
WEIR ELEV. (ft-NGVD)		

ORIFICE FLOW EQUATION: $Q = 0.6A(2gH)^{0.5}$
WEIR FLOW EQUATION: $Q = 3.0L(H)^{1.5}$

ELEVATION-DISCHARGE RELATIONSHIP

Elevation (feet)	Q-orifice #1 (cfs)	Q-orifice #2 (cfs)	Q-weir #1 (cfs)	Q-weir #2 (cfs)	Q-total (cfs)
698.0	0.00	0.00	0.00	0.00	0.00
698.5	0.67	0.00	0.00	0.00	0.67
699.0	1.29	0.00	0.00	0.00	1.29
699.5	1.70	0.00	0.00	0.00	1.70
700.0	2.03	0.00	0.00	0.00	2.03
700.5	2.31	0.00	0.00	0.00	2.31
701.0	2.56	0.00	0.00	0.00	2.56
701.5	2.79	0.00	0.00	0.00	2.79
702.0	3.00	0.00	0.00	0.00	3.00



Restrictor for Detention Basin 2 assuming free flow (no tailwater)

PROPOSED CONDITIONS
ORIFICE/WEIR STRUCTURE RATING ANALYSIS

PROJECT NAME:	Example 5.9
PROJ. NO.:	13-0409
DESCRIPTION:	Detention Basin 2
FILENAME:	Orifice.xlsx
DATE:	9-Feb-14

OUTLET:

ORIFICE #1:	7.65	IN. DIA. @ ELEV	698
ORIFICE #2:	N/A	IN. DIA. @ ELEV	N/A
WEIR #1:	N/A	FEET WIDE @ ELEV	N/A
WEIR #2:	N/A	FEET WIDE @ ELEV	N/A

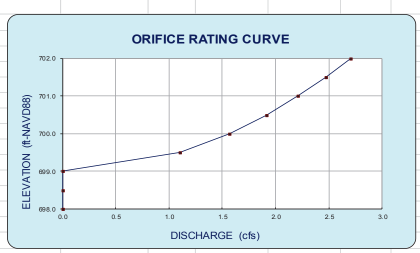
HYDRAULIC DIMENSIONS

	# 1	#2
ORIFICE AREA (ft^2)	0.3192	
ORIFICE DIAMETER (in)	7.7	
ORIFICE DISCHARGE COEFFICIENT	0.61	
ORIFICE ELEV. (ft-NAVD88)	698.00	
TAILWATER OR CENTROID (ft-NAVD88)	699.00	
WEIR LENGTH (ft)		
WEIR COEFFICIENT		
WEIR ELEV. (ft-NGVD)		

ORIFICE FLOW EQUATION: $Q = 0.6A(2gH)^{0.5}$
WEIR FLOW EQUATION: $Q = 3.0L(H)^{1.5}$

ELEVATION-DISCHARGE RELATIONSHIP

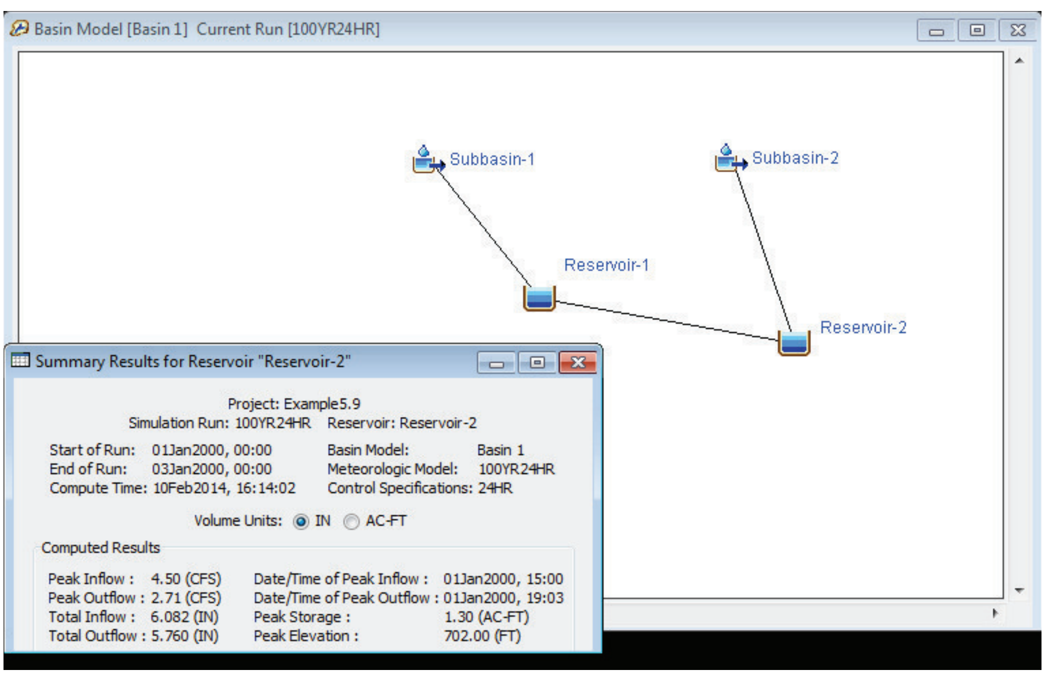
Elevation (feet)	Q-orifice #1 (cfs)	Q-orifice #2 (cfs)	Q-weir #1 (cfs)	Q-weir #2 (cfs)	Q-total (cfs)
698.0	0.00	0.00	0.00	0.00	0.00
698.5	0.00	0.00	0.00	0.00	0.00
699.0	0.00	0.00	0.00	0.00	0.00
699.5	1.10	0.00	0.00	0.00	1.10
700.0	1.56	0.00	0.00	0.00	1.56
700.5	1.91	0.00	0.00	0.00	1.91
701.0	2.21	0.00	0.00	0.00	2.21
701.5	2.47	0.00	0.00	0.00	2.47
702.0	2.71	0.00	0.00	0.00	2.71



Restrictor for Detention Basin 2 assuming tailwater of 699 ft

Step 5: Using the elevation-storage spreadsheet and solving iteratively, it is determined that 1.30 acre-feet of storage volume is required for Detention Basin 2, which allows the basin to fill up to its HWL of 702 ft and release at the **allowable release rate**. Note that when there is a 100-year tailwater on the detention basin, the release rate is only 2.7 cfs. When there is no tailwater condition, the outflow of the detention basin will be no greater than the maximum **allowable release rate** of 3.0 cfs.

POND:	Proposed Detention Facility 2			Centerline Elevation		
JOB NO.		130409		Side Slopes	Orifice Radius:	
PROJECT:		Example 5.7		1	Orifice Coeff:	
FILE:		Storage.xls		4	Weir Elevation:	
DATE:		2/10/2014			Length of Weir	
DA					Weir Coeff	
		Area		Average	Incremental	Cummulative
Elevation	INC			Area	Storage	Storage
(ft)	0.25	(ft2)	(ac)	(ac)	(ac-ft)	(ac-ft)
698.00		10,522	0.242			
				0.261	0.26	
699.00		12,228	0.281			0.261
				0.302	0.30	
700.00		14,061	0.323			0.563
				0.345	0.35	
701.00		16,022	0.368			0.908
				0.392	0.39	
702.00		18,112	0.416			1.300



Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

Name of Project: Example 5.9

A. DEVELOPMENT INFORMATION

1) Total parcel area: 10.0 acres
2) Total development area on the parcel: 10.0 acres

B. SITE VOLUME CONTROL REQUIREMENTS

1) Existing impervious area of development: 0.38 acres
2) Proposed impervious area of development: 3.50 acres
3) Gross volume control storage required (0.083 X Line B.2): 0.29 acre-feet
4) Volume control storage allowance. Do site constraints prevent the use of retention-based practices in full? ☐ Yes ☑ No
   If yes, explain and complete B.4.a, B.4.b, and B.4.c ____________
   a. Percent reduction in impervious area (B.1 – B.2)/B.1: ____________%
   b. Volume control storage allowance (Line B.4.a/5%)(0.25)(Line B.3): ____________acre-feet
   c. Volume control treated by a flow through practice: ____________acre-feet
5) Net volume control storage required (Line B.3 – Line B.4.b – Line B.4.c): 0.29 acre-feet
6) Volume control storage provided (must be greater than line B.5) : 0.29 acre-feet

C. SITE DETENTION REQUIREMENTS

1) Type of stormwater detention facility (check one)

   ☑ Reservoir
   ☐ Parking Lot
   ☐ Offsite Facility
   Location____________
   ☐ Other
   Specify____________

2) Release Rate Determination
   A) Existing conditions 100-year runoff rate for the development: N/A cfs
   (if the development contains depressional storage)
   B) Gross allowable release rate: 3.0 cfs
   (lesser of Line C.2.A or 0.30 x Line A.2)
   C) Unrestricted release rate: 0.00 cfs
   (assume 0 cfs if equivalent upstream area is being diverted to the detention facility)
   D) Unrestricted native planting area
      i. Area: N/A acres
      ii. Reduction in release rate: N/A cfs (0.30 x Line C.2.D.i)

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 1 OF 3

Schedule D Form for Example 5.9 (Page 1 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

E) Net allowable release rate: 3.00 cfs
(Line C.2.B – Line C.2.C - Line C.2.D.ii)

3) Detention Volume Determination
(Submit calculations for items C.3.A through C.3.H)

a. Methodology

☐ Nomograph

■ Hydrologic model (select modeling software and indicate version)

■ HEC-HMS Version 4.0

☐ TR-20 ______

☐ WIN TR-20 ______

b. Composite CN for the development: 92 (Subbasin 1), 88 (Subbasin 2)

c. Reduced CN for the development: 88.79 (Subbasin 1), 85.36 (Subbasin 2)

d. Time of concentration for the development: 15 (Subbasin 1), 10 (Subbasin 2) minutes

e. Required detention volume at actual release rate: 2.70 acre-feet

f. Actual detention volume provided at HWL: 1.40 (Subbasin 1) 1.30 (Subbasin 2) acre-feet

g. Actual release rate: 2.71 (Basin 2) cfs at HWL 702.00 (Basin 2) ft (NAVD 88)
(cannot be greater than Line C.2.E)

h. Outlet control structure (provide details and calculations)

i. Orifice
1. Type: Sharp-edge
2. Discharge coefficient: 0.61 (Both basins)
3. Diameter: 5.90; 7.65 in
4. Orifice invert elevation 700.00; 698.00 ft (NAVD 88)

ii. Weir
1. Weir length: 6.0 (Basin 1) 12.0 (Basin 2) ft
2. Weir invert elevation: 704.00 (Basin 1) 702.00 (Basin 2) ft (NAVD 88)

D. UPSTREAM TRIBUTARY AREA

1) Upstream tributary drainage area: 0.00 acres

A) Ratio of upstream tributary area to development area: N/A

B) Composite CN for upstream tributary area: N/A

C) Time of concentration for upstream tributary area: N/A minutes

D) 100-year peak flowrate for upstream tributary area: N/A cfs

E) Detention facility drawdown time: N/A hours

Schedule D Form for Example 5.9 (Page 2 of 3)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D
WATERSHED MANAGEMENT FACILITIES

2) Describe bypass system type details: ☐ Overflow weir ☐ Restrictor

Orifice diameter: N/A in Orifice invert elevation: N/A ft (NAVD 88)

Orifice type and discharge coefficient: N/A

Weir length: N/A ft Weir invert elevation: N/A ft (NAVD 88)

Name John Smith Title Project Engineer

Signature______ Date 4/28/14

Engineering Firm Smith Engineering

PE SEAL

4/14 WMO SCHEDULE D – WATERSHED MANAGEMENT FACILITIES PAGE 3 OF 3

Schedule D Form for Example 5.9 (Page 3 of 3)

Site Detention Facilities within the Floodplain

The WMO (§504.13) allows **site detention facilities** in areas outside of the **regulatory floodway**, but within the **regulatory floodplain** provided that they:

1. Conform to all applicable requirements specified in Article 6, and in particular §602.18; and

2. Store the **site runoff** from the **development** such that the **allowable release rate** determined in §504.3 and adjusted in §504.5 and/or §504.6 is not exceeded, assuming a zero release rate (0 cfs) below the **BFE**.

Other Requirements

The WMO (§504.15) requires that **site detention facilities** be functional before occupancy permits are issued for residential and **non-residential subdivisions** or before **sanitary sewers** are placed in service. In addition, §504.16 requires that **site detention facilities** shall be functional for **developments** before **building** or road construction begins.

Offsite Facilities

If it is not practicable to provide a **detention facility** onsite, an **offsite detention facility** may be constructed if **all** of the following conditions are met:

1. The required **volume control storage** is provided onsite;

2. The **co-permittee** demonstrates that **site** limitations prevent the **development** from providing the full volume of the **detention facility** onsite;

3. The **parcel** area is less than ten (10) acres;

4. **Stormwater** detention is provided in accordance with the following hierarchy:

    a. Partially onsite in a **detention facility** with supplemental storage offsite in an **offsite detention facility** according to (b), (c) and (d) below;

    b. Offsite in an **offsite detention facility** where the **development** conveys the 100-year **storm event** to the **offsite detention facility**;

    c. Offsite in an **offsite detention facility** in a location that is upstream or hydrologically equivalent to the **development** in the same **subwatershed**; or

    d. Offsite in an **offsite detention facility** within the same **subwatershed**;

As described above, offsite detention is only an option for those **parcels** with areas between 3 acres and 10 acres (detention is not required for **parcels** ≤ 3 acres under the WMO), although **parcels** containing the offsite storage can be of unlimited size. When offsite detention is proposed, the **co-permittee** must demonstrate how the hierarchy outlined in (4) was followed for the **development**. An explanation of the navigation through the hierarchy should be included in the narrative in the **stormwater** submittal.

The **offsite detention facility** must be permitted and functional prior to the permitting of the **development** that is seeking detention credit. The WMO allows collaboration with either the Cook County Land Bank Authority or the South Suburban Land Bank and Development Authority to facilitate the trading of detention credits. Concurrence of the **District** or an **authorized municipality** should be sought prior to the start of the design of an **offsite detention facility.**

The design of **offsite detention facilities** must comply with the requirements of §500, §501, §502, §503, and §504 of the WMO, and shall not adversely impact upstream or downstream properties as described in §501.1.

Site Detention Exemptions

The WMO (§504.17) exempts certain types of **development** from the **site** detention requirements. Those **developments** that are tributary to Lake Michigan and provide water quality benefits will be exempt from providing **stormwater** detention. Specifically, the **development** must comply with the following conditions, as outlined in the WMO:

- The **development** discharges **stormwater** to a **storm sewer** tributary to Lake Michigan;
- The downstream receiving **storm sewer** has adequate capacity as determined by the governing **municipality**;
- The **development** complies with the **site** volume control requirements (WMO §503); and
- The **development** intercepts and treats all **stormwater runoff** onsite to improve water quality prior to discharge from the **development**.

The Lake Michigan water quality structure may be a stormwater treatment train of various BMPS, or may consist of a hydrodynamic separator with a settling or separation unit to remove sediments, hydrocarbons, and other pollutants commonly found in stormwater runoff. There are many manufactured hydrodynamic separation systems available, but the suitability of each type will vary based on the tributary area and stormwater runoff characteristics of each site.

The water quality benefits are satisfied by demonstrating the following stormwater runoff pollutant removal standards:

- 80% Total Suspended Solids (TSS) removal, with TSS defined by the Ok-110 particle size distribution (PSD)

- 80% of free floatable hydrocarbons
- 100% of floating trash and debris

The water quality structure must have the capacity to treat peak flowrate/runoff volume for the 2-year, 24-hour storm event (3.04 inches based on Bulletin 70), which is considered the "first flush" storm event. Additionally, the water quality structure must contain an overflow system that safely bypasses flows in excess of the 2-year, 24-hour design flowrate. A typical detail for a Lake Michigan water quality structure is provided in Appendix C.

ALLOWANCES FOR REDEVELOPMENT & DEVELOPMENT SUBJECT TO A LEGACY SEWERAGE SYSTEM PERMIT (§505)

The WMO separates the **stormwater** detention requirements for **redevelopments** into four categories: (1) the **parcel** that is to be redeveloped includes an **existing detention facility** permitted under the **Sewer Permit Ordinance (SPO)**, (2) the **parcel** was not tributary to an **existing detention facility** permitted under the **SPO**, but will be under proposed conditions, (3) the **parcel** to be redeveloped contains an **existing detention facility** that was permitted under a local **ordinance**, but not under the **SPO**; and (4) the **parcel** that is to be redeveloped does not contain a previously permitted **detention facility** and will not be tributary to one under proposed conditions. For those **redevelopments** that involve **parcels** that were never planned to be tributary to or do not contain an **existing detention facility** permitted under the **SPO** ((4) above), the **redevelopment** must comply with the **stormwater** management requirements described in §500 through §504 of the WMO. As detailed below, the WMO makes allowances for the **redevelopment** of **parcels** that involve previously permitted **existing detention facilities** and can meet certain conditions ((1), (2) and (3) above).

Parcels That Involve Existing Detention Facilities Permitted Under the SPO

For those **redevelopments** that involve an **existing detention facility** that was permitted under the **SPO** ((1) and (2) above), the WMO provides allowances if the following conditions are met:

1. Documentation is provided demonstrating the **existing detention facility** was designed, approved, and permitted under the **SPO**. At a minimum, the Schedule D form for the existing **development** must be provided.

2. The actual storage volume provided in the **existing detention facility** either meets or exceeds the permitted storage volume and is verified by a recent survey, signed and sealed by a **Professional Engineer** or **Professional Land Surveyor**.

3. The **redevelopment** meets the volume control requirements of the WMO.

4. The **redevelopment** provides adequate capacity to convey **stormwater runoff** to the **detention facility** for all storms up to the 100-year **storm event**.

If the **redevelopment** can meet these four conditions, the following detention allowances are granted by the WMO:

1. If the composite **runoff** coefficient (C) of the **redevelopment** does not exceed the C value of the existing **development** permitted under the **SPO** (found on the Schedule D form), additional **stormwater** detention volume is not required. When determining increases in C values for detention allowances, the C value should always be analyzed to two decimal places.

2. If the **redevelopment's** C value exceeds the C value of the existing **development** (found on the Schedule D form), the additional **stormwater** detention volume may be calculated using the modified Rational Method and **Bulletin 70** sectional rainfall depths. For these cases, the **allowable release rate** can be calculated using the following:

    a) If the **redevelopment** is within a permitted **parcel** intended to be tributary to an **existing detention facility**, the existing approved release rate and restrictor may be used.

    b) If the **redevelopment** is an area within a permitted **parcel**, which was never intended to be tributary to an **existing detention facility**, but will be tributary upon **redevelopment**, the original release rate for the basin must be recalculated using the proportion of original **tributary area** to new **tributary area**. The total new required detention volume is based on the pro-rated release rate and the existing restrictor may need to be replaced.

If the **redevelopment** only requires a marginal increase in detention storage compared to the provided storage volume in the existing facility, then no additional volume is required. The "marginal" increase in required volume is defined as less than 0.10 acre-feet or within 2% of the existing storage volume provided.

Any modifications to the **existing detention facility** that are necessary to provide the new required storage volume are considered to be **non-qualified development**, and this area of disturbance is not included in the calculation of required detention volume.

It should be noted that the WMO detention allowances are dedicated for **redevelopments** that utilize the existing detention located on the project site. If a **redevelopment** will completely reconfigure the site and relocate the **existing detention facility**, the **redevelopment** detention allowances will not apply to the **site**. Any **redevelopments** that completely reconfigures the existing developed portion of the site and also result in the removal or relocation of 75% or more of the existing detention volume must meet the full detention requirements of the WMO (§504).

A special case of **redevelopment** occurs when a **parcel** was originally permitted as part of a larger **development**. To avoid penalizing a redeveloper of a single **parcel** with providing additional detention volume for the entire **development**, a special methodology has been developed for these cases. Referring to Figure 5.26, Parcels 1-4 were originally permitted as a single **development**. If an applicant wants to redevelop only Parcel 3, the methodology for determining the additional storage volume required is provided below.

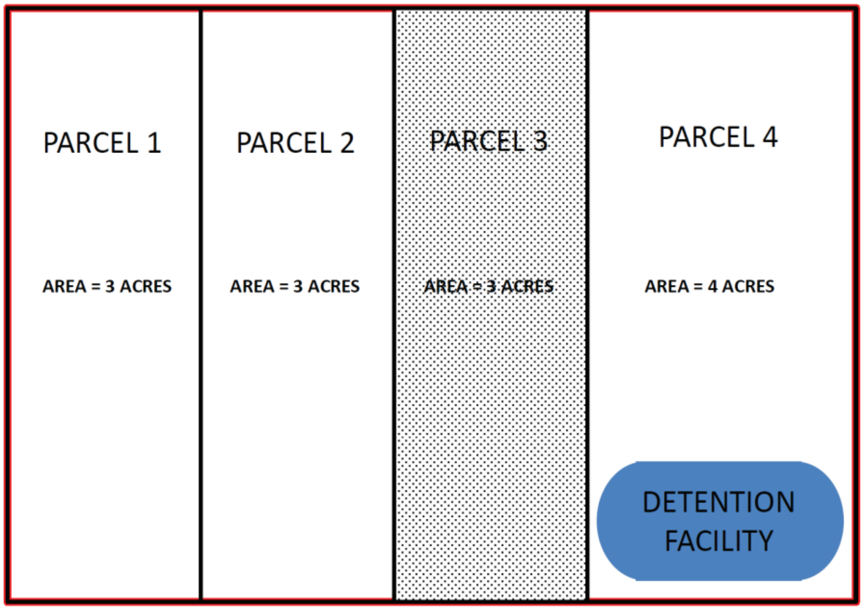


Figure 5.26. Redevelopments of Parcels Part of a Larger Development

The first step is to calculate the proposed C value of the entire **development**, C_{REDEV}, which includes the redeveloped **parcel**. If C_{REDEV} is greater than the permitted C value for the original **development**, C_{PERMIT}, additional storage is required.

The second step is to determine the amount of permitted volume that was allocated just for **Parcel** 3, which is calculated by the following:

$$\frac{V_{PERMIT}}{A_{PERMIT}} \quad x \quad A_{PARCEL\ 3} \quad = \quad V_{PERMIT,3} \text{ (Permitted Storage Volume Allocated to Parcel 3)}$$

Using the modified Rational Method with **Bulletin 70** rainfall depths, the third step is to determine the pro-rated <u>required</u> detention volume for the three-acre **parcel**.

$$\frac{V_{REDEV}}{A_{PERMIT}} \quad x \quad A_{PARCEL\ 3} \quad = \quad V_{REDEV,3} \text{ (Required Storage Volume for Parcel 3)}$$

The last step is to determine the additional storage volume that must be provided for the **redevelopment** of Parcel 3, which can be calculated by:

Additional storage volume required = $V_{REDEV,3}$ - $V_{PERMIT,3}$

If the additional storage volume required is less than or equal to 0.10 ac-ft or within 2% of the original volume allocated for the **parcel**, then additional storage volume is not required. Any **volume control storage** that is provided as part of the **redevelopment** of the **parcel** is credited toward the required additional volume.

Example 5.10 – Detention Requirements for Redevelopment

An existing 11.3-acre industrial area is to be redeveloped into a shopping mall. The original **development** contains a **detention facility** that was permitted under the **Sewer Permit Ordinance (SPO)**. The proposed **development** has a C value of 0.90, with 8.0 acres of **impervious area**. It is assumed that the proposed **development** will provide the 1 inch of **volume control storage**. Determine the required detention volume for the **site**.

Step 1: Obtain the Schedule D form for the original **development** to determine the composite **runoff** coefficient (C value) and required detention volume that was permitted. As shown on Page 2 of the Schedule D form, the permitted **development** in this example has a C value of 0.88 and a required detention volume of 3.07 acre-feet.

SCHEDULE D – DETENTION **MWRDGC Permit No.** [redacted]

A. PROJECT INFORMATION

Name of Project [redacted]
(as shown on plans)

B. METHOD OF DETENTION:

☒ Reservoir ☐ Rooftop ☐ Parking Lot ☐ Others _

C. UNDEVELOPED SITE_DETERMINATION OF ALLWABLE RELEASE (Delineate total, developed, undeveloped and unrestricted areas on a grading plan)

1.	Area of Site	11.334	acres
2.	Average Ground Slope	0.0024	feet/foot
3.	Longest overland flow distance (Shown on a contour map for undeveloped site)	1250	feet
4.	Overland flow time of concentration	97	minutes
5.	Average slope of channelized flow (see note)	--	feet/foot
6.	Channelized flow distance (see note)	--	feet
7.	Channelized flow time of concentration	--	minutes
8.	Total time of concentration (line 4 + line 7)	97	minutes
9.	Rainfall intensity for 3- year storm	1.21	inches/hr.
10.	Gross Allowable release rate (0.15 x line 9 x line 1 or Q_{all}=0.15 x i_3 x A)	2.057	cfs
11.	Unrestricted release rate (Q_{un}) $Q_{un} = C_{un}(i_{un-100})(A_{un})$	0.874	cfs
12.	Net allowable release rate (line 10 – line 11)	1.183	cfs
13.	Actual release rate at HWL 594.00-ft (must be less than or equal to line 12)	1.183 (H.W.=594.00)	cfs
14.	Restrictor type and size INV = 588.90-ft (provide details and calculations)	4.47 (H.W.=594.00) (SHARP)	inches

NOTE: For flow time in a well defined channel, determine time of concentration from measured lengths, cross-sections and slopes. Submit necessary calculations.

Page 1 of 2

SCHEDULE D – DETENTION **MWRDGC Permit No** [redacted]

CE COPY

D. DEVELOPED SITE-DETERMINATION OF RESERVOIR SIZE
(Submit calculations for Items 1 through 6)

1.	Impervious drainage area excluding wet	9.431	acres
2.	Impervious wet pond area[1]	0.965	acres
3.	Pervious drainage area[1]	0.796	acres
4.	Composite runoff coefficient (C)	0.88	
5.	Required detention capacity provided at Q= 1.18 -cfs	3.07 (H.W.=(593.98)	acre-feet
6.	Actual detention capacity provided at HWL 594.00 ft	3.084 (H.W.=594.00)	acre-feet

[1] Unrestricted areas shall be excluded here. (0.115-AC IMPERVIOUS AND 0.027-AC PERVIOUS)

E. REQUIRED BYPASS RATE THROUGH DEVELOPMENT SITE FROM UPSTREAM AREA

Note: Following steps are applicable to bypass flow over a weir or bypassing detention system. Design frequency shall be determined by local ordinance. If no local requirement is established, use 5-year storm frequency. (Delineate bypass areas on grading plans or USGS maps).

1.	Total area upstream	N/A	acres
2.	Impervious area		acres
3.	Pervious area		acres
4.	Composite runoff coefficient (minimum of 0.35)		
5.	Design storm frequency for the upstream area		year
6.	Time concentration for upstream area at point of entry; upstream area to be considered as developed		minutes
7.	Rainfall intensity for time of concentration		inches/hr.
8.	Permissible bypass rate (line 1 x line 4 x line 7)		cfs
9.	Bypass system – Type & capacity (provide detail and calculations)		cfs

Name [redacted] Title [redacted]
Signature [redacted] Date [redacted]
Engineering Firm [redacted]

Page 2 of 2

Step 2: Determine if the **redevelopment** can meet the conditions for detention allowances provided in Section §505.3 of the WMO. The four conditions are:

1. Design of the **existing detention facility** is documented and approved under an existing **sewerage system permit**;

2. The actual storage volume is verified to meet the required permitted volume (3.07 acre-feet in this example) by a survey;

3. The **redevelopment** will meet the volume control requirements of the WMO; and

4. The **redevelopment** provides adequate conveyance to convey the 100-year peak flowrates to the **detention facility**.

Step 3: Assuming the **redevelopment** can meet the four conditions outlined above, calculate the **redevelopment's** C value. Using the values provided in Table 5-2 of the **TGM**, the redeveloped C value is 0.90. Because the redeveloped C value (0.90) is greater than existing (0.88), additional detention storage is required. If the redeveloped C value were to match the permitted C value of 0.88, no additional storage volume would be required.

Step 4: Determine the required storage volume for the **redevelopment** using the modified Rational Method and **Bulletin 70** rainfall depths. Since the **existing detention facility** was previously permitted under the **SPO**, the original release rate and restrictor can be used. From Page 1 of the Schedule D form, the **allowable release rate** is 1.183 cfs. (Note that the release rate of 1.183 cfs calculated for the original **development** included unrestricted releases; if the **redevelopment** causes additional unrestricted releases, or if the applicant wants to use a larger release rate because unrestricted areas have been reduced, a modification to the outlet control **structure** would be required.)

DETENTION STORAGE CALCULATIONS (Bulletin 70 NE Sectional Rainfall Intensities)					
PROJECT:	Example 5.10				
JOB NO.:	Technical Guidance Manual				
FILENAME:	ModRatB70.xlsx				
DATE :	5-Feb-14				
	TRIBUTARY AREA =			11.33	acres
	COMPOSITE RUNOFF COEFFICIENT =			0.90	
	ALLOWABLE RELEASE RATE =			1.18	cfs
	COMPUTED DETENTION STORAGE =				4.441 acre-ft

DURATION (hours)	TIME (min.)	RAINFALL INTENSITY (in/hr)	INFLOW RATE (cfs)	STORED RATE (cfs)	RESERVOIR SIZE (ac-ft)
0.08	5	10.90	111.19	110.01	0.758
0.17	10	10.02	102.21	101.03	1.392
0.25	15	8.20	83.64	82.46	1.704
0.33	20	7.30	74.46	73.28	2.019
0.50	30	5.60	57.12	55.94	2.311
0.67	40	4.58	46.72	45.54	2.509
0.83	50	3.97	40.50	39.32	2.708
1	60	3.56	36.31	35.13	2.903
1.5	90	2.68	27.34	26.16	3.243
2	120	2.24	22.85	21.67	3.581
3	180	1.62	16.52	15.34	3.803
4	240	1.40	14.28	13.10	4.330
5	300	1.17	11.93	10.75	***4.441*** ←
6	360	0.95	9.69	8.51	4.218
7	420	0.83	8.47	7.29	4.216
8	480	0.75	7.65	6.47	4.276
9	540	0.68	6.94	5.76	4.282
10	600	0.63	6.43	5.25	4.336
11	660	0.59	6.02	4.84	4.397
12	720	0.55	5.61	4.43	4.390
18	1080	0.39	3.98	2.80	4.161
24	1440	0.32	3.26	2.08	4.120
36	2160	0.22	2.24	1.06	3.145
48	2880	0.17	1.73	0.55	2.170

Using the modified Rational Method and **Bulletin 70** rainfall depths, the required detention volume for the **redevelopment** is 4.44 acre-feet. Since the provided detention storage for the original **development** was 3.07 acre-feet (and was verified by a survey), the additional storage that is required is 1.37 acre-feet. Any **volume control storage** that is provided is credited toward the required storage volume.

It should be noted that while the WMO provides detention allowances for **redevelopments**, all other requirements of the WMO may still be applicable. The overflow weir for the **detention facility**, for example, may need to be retrofitted to meet the design requirements of the WMO if there is a known drainage problem associated with the **parcel**.

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Name of Project: Example 5.10

A. DEVELOPMENT INFORMATION

1) Total parcel area: 11.334 acres
2) Total re/development area on the parcel: 11.334 acres

B. SITE VOLUME CONTROL REQUIREMENTS

1) Existing impervious area of re/development area: 10.40 acres
2) Proposed impervious area of re/development area: 8.0 acres
3) Gross volume control storage required (0.083 X Line B.2): 0.67 acre-feet
4) Do site constraints prevent the use of retention-based practices in full? ☐ Yes ■ No
   If yes, explain and complete B.4.a, B.4.b, and B.4.c for volume control storage allowance:
   ____
   a. Percentage reduction in impervious area (B.2 – B.1)/B.1: __________%
   b. Volume control storage allowance (Line B.5.a/5%)(0.25)(Line B.3): __________acre-feet
   c. Volume control treated by a flow through practice: __________acre-feet
5) Net volume control storage required (Line B.3 – Line B.4.b – Line B.4.c): 0.67 acre-feet
6) Volume control storage provided (must be greater than line B.5): 0.67 acre-feet

C. RELATIONSHIP TO LEGACY SPO

Check one of the following conditions that apply:

■ Development is tributary to existing detention facilities permitted under the SPO

☐ Development is part of the ownership area of an existing permitted parcel under the SPO (Not currently tributary; encumbered under Legacy Schedule L, or otherwise)

☐ Development is tributary to an existing unpermitted detention facility

Legacy Permit Information (approved Schedule D form):

1) Provide Legacy SPO Permit No(s),: XX-XXXX
2) Total "Area of Site" (Legacy Sch. D, Item C-1) : 11.334 acres
3) "Total Contiguous Ownership, including project" (Legacy Sch. A, 6-B) : 11.334 acres
4) "Net Allowable Release Rate" (Legacy Sch. D, Item C-12): 1.183 cfs
5) "Composite Runoff Coefficient (C)" (Legacy Sch. D, Item D-4): 0.88
6) "Required Detention Capacity at actual release rate" (Legacy Sch. D, Item D-5): 3.07 acre-feet

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 1 OF 4

Schedule D-Legacy for Example 5.10 (Page 1 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Unpermitted Existing Facility Information:

7) Tributary area to existing facility: ______ acres
8) Existing release rate (must be less than 0.30 cfs/ac): ______ cfs
9) Existing composite runoff coefficient: ______
10) Verified detention volume capacity (from survey): ______ acre-feet

D. DEVELOPMENT TRIBUTARY TO EXISTING DETENTION FACILITY(S)

Existing Detention Sufficient

1) Original total composite runoff coefficient (C.5) 0.88
2) Proposed composite runoff coefficient (for sub re/development area) 0.90

If D.2 ≤ D.1, no additional detention volume is required, complete D & proceed to G)
If D.2 > D.1, proceed to (D.5).

3) Original required detention volume capacity (C.6): ______ acre-feet
4) Verified actual existing detention volume serving proposed development: ______ acre-feet

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

5) Original total composite runoff coefficient (C.5): 0.88
6) Proposed composite runoff coefficient (for sub re/development area): 0.90
7) Permitted release rate for the original facility (C.4): 1.183 cfs
8) Original required detention volume capacity (C.6): 3.07 acre-feet
9) Existing detention volume pro-rated for the sub re/development area (C.6/C.2 * A.2): 3.07 acre-feet
10) Proposed required detention volume capacity (based on C.2): 4.44 acre-feet
11) Proposed detention volume pro-rated for the sub re/development area (D.10/C.2 * A.2): 4.44 acre-feet
12) Verified actual existing detention volume (from survey): 3.07 acre-feet
13) Additional detention volume required†: (D.11 – D.9): 1.37 acre-feet
14) Additional storage volume provided (then proceed to G): 0.67 (Vol Cont) 0.70 (Det.) acre-feet

E. DEVELOPMENT NOT PREVIOUSLY TRIBUTARY TO MWRD PERMITTED DETENTION FACILITY

New Release Rate

1) Cfs/acre for original permit area (C.4/C.2): ______ cfs/acre
2) Release rate for new area (A.2 * E.1): ______ cfs
3) New total release rate required for entire existing system (E.2 + C.4): ______ cfs

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 2 OF 4

Schedule D-Legacy for Example 5.10 (Page 2 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

4) Required detention volume for new development (per Bull. 70 & w/ new release (E.2): ________________acre-feet
5) Required new total detention volume (C.6 + E.4): ________________________acre-feet
6) Verified actual existing detention volume (per survey):_____________________ acre-feet
7) Additional detention volume required† (E.5 – E.6): ______________________ acre-feet
8) Additional storage volume provided (then proceed to G): __________________ acre-feet

F. DEVELOPMENT TRIBUTARY TO UNPERMITTED DETENTION FACILITY(S)

Existing Detention Sufficient (Use Modified Rational method with TP-40 Rainfall Depths):

1) Original total composite runoff coefficient (C.9): ______________________
2) Original allowable release rate (C.8): ______________________ cfs
3) Original required detention volume capacity (based on C.7): ________________acre-feet
4) Verified actual existing detention volume (per survey): ______________acre-feet
5) Existing impervious area of re/development: ____________________acres
6) Proposed impervious area of re/development: ___________________acres

If F.6 ≤ F.5, no additional detention volume is required, proceed to G)
If F.6 > F.5, proceed to (F.7).

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

7) Proposed composite runoff coefficient for re/development area:________________
8) Allowable release appropriated to proposed re/development (F.2/C.7 *A.2): __________cfs
9) Required detention volume for proposed re/development: ___________________ acre-feet
10) Existing detention volume pro-rated for re/development area (F.3/C.7 * A.2): ____________________ acre-feet
11) Additional detention volume required †: (F.9 – F.10): ____________________ acre-feet
12) Additional storage volume provided (then proceed to G): ___________________acre-feet

† If additional volume required ≤ 0.10 acre-feet or 2% of total required, no additional volume required. Note, volume control storage provided can be credited toward the required volume

G. EXISTING / PROPOSED DETENTION FACILITY PARAMETERS
(Document existing, provide details and calculations if proposed)
Type of stormwater Detention Volume (check one)

- ■ Reservoir
- ☐ Parking Lot
- ☐ Other Specify________________
- ☐ Offsite Facility Location ______________

1) Actual detention volume provided at HWL (NAVD 88): 3.77 acre-feet
2) Actual release rate at HWL: 1.183 cfs

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 3 OF 4

Schedule D-Legacy for Example 5.10 (Page 3 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

3) HWL (NAVD 88): 594.00 ft

Type of Stormwater Outlet Control Structure:

4) Type: Sharp-edge Orifice
5) Discharge coefficient: 0.61
6) Diameter: 4.47 in
7) Orifice invert elevation (NAVD 88): 588.90 ft
8) Weir length: 10.0 ft
9) Weir invert elevation (NAVD 88): 594.00 ft

H. UPSTREAM TRIBUTARY AREA AND BYPASS SYSTEMS
(Document existing, provide details and calculations if proposed)

1) Upstream tributary drainage area: N/A acres
   A) Ratio of upstream tributary area to development area: ______
   B) Detention facility drawdown time: ______ hrs
   C) Composite CN for upstream tributary area: ______
   D) Time of concentration for upstream tributary area: ______ minutes
   E) 100-year peak flowrate for upstream tributary area: ______ cfs

2) Describe bypass system type details: ☐ Overflow weir ☐ Restrictor
   Orifice diameter: ______ in Orifice invert elevation: ______ ft (NAVD 88)
   Orifice type and discharge coefficient: ______
   Weir length: ______ ft Weir invert elevation: ______ ft (NAVD 88)

I. CERTIFICATION

The undersigned professional engineer certifies that the design of the stormwater management facilities:

1. Are in accordance with §501.1 of the WMO, and will have no adverse impacts on adjacent and downstream properties;
2. Proposed collection systems and sewers have sufficient capacity to collect and convey the 100-yr site stormwater runoff to the basin and;
3. The bypass system (existing or proposed) is designed with sufficient capacity for emergency overland flow of upstream and onsite areas.

Name John Smith Title Project Engineer

Signature ______ Date 4/28/14

Engineering Firm Smith Engineering

PE
SEAL

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 4 OF 4

Schedule D-Legacy for Example 5.10 (Page 4 of 4)

Example 5.11 –Redevelopment of a Parcel Permitted as Part of Larger Development

For the **site** in Example 5.10, determine the required detention volume if only a 6-acre portion of the **site** is to be redeveloped. Of the 6 acres that is to be redeveloped, 5.4 acres are impervious.

Step 1: Calculate the proposed C value of entire **development**, C_{REDEV}, which includes redeveloped **parcel**. If C_{REDEV} is greater than the permitted C value for the **development**, C_{PERMIT}, additional storage volume is required.

C_{PERMIT} = 0.88 (from Schedule D form for original **development**)

C_{REDEV} = 0.89 (entire **development** including redeveloped 6-acre **parcel**)

Since C_{REDEV} is greater than C_{PERMIT}, additional storage volume is required.

Step 2: Determine the pro-rated permitted detention volume for the 6-acre **parcel**. From Schedule D for the original **development**, 3.07 acre-feet is required for the 11.33-acre **development**. The pro-rated detention volume for the 6-acre **parcel** is calculated as such:

$$\frac{3.07 \text{ acre-feet}}{11.33 \text{ acres}} \quad \text{x} \quad 6 \text{ acres} \quad = \quad 1.63 \text{ acre-feet}$$

Step 3: Using the modified Rational Method with **Bulletin 70** rainfall depths, determine the pro-rated required detention volume for the 6-acre **parcel**.

$$\frac{4.39 \text{ acre-feet}}{11.33 \text{ acres}} \quad \text{x} \quad 6 \text{ acres} \quad = \quad 2.32 \text{ acre-feet}$$

DETENTION STORAGE CALCULATIONS
(Bulletin 70 NE Sectional Rainfall Intensities)

PROJECT: Example 5.10
JOB NO.: Technical Guidance Manual
FILENAME: ModRatB70.xlsx
DATE : 5-Feb-14

TRIBUTARY AREA = 11.33 acres
COMPOSITE RUNOFF COEFFICIENT = 0.89
ALLOWABLE RELEASE RATE = 1.18 cfs

COMPUTED DETENTION STORAGE = **4.387 acre-ft**

DURATION (hours)	TIME (min.)	RAINFALL INTENSITY (in/hr)	INFLOW RATE (cfs)	STORED RATE (cfs)	RESERVOIR SIZE (ac-ft)
0.08	5	10.90	109.91	108.73	0.749
0.17	10	10.02	101.04	99.86	1.375
0.25	15	8.20	82.69	81.51	1.684
0.33	20	7.30	73.61	72.43	1.995
0.50	30	5.60	56.47	55.29	2.285
0.67	40	4.58	46.18	45.00	2.479
0.83	50	3.97	40.03	38.85	2.675
1	60	3.56	35.90	34.72	2.869
1.5	90	2.68	27.02	25.84	3.203
2	120	2.24	22.59	21.41	3.538
3	180	1.62	16.34	15.16	3.758
4	240	1.40	14.12	12.94	4.277
5	300	1.17	11.80	10.62	***4.387*** ←
6	360	0.95	9.58	8.40	4.164
7	420	0.83	8.37	7.19	4.158
8	480	0.75	7.56	6.38	4.216
9	540	0.68	6.86	5.68	4.223
10	600	0.63	6.35	5.17	4.270
11	660	0.59	5.95	4.77	4.334
12	720	0.55	5.55	4.37	4.331
18	1080	0.39	3.93	2.75	4.086
24	1440	0.32	3.23	2.05	4.060
36	2160	0.22	2.22	1.04	3.085
48	2880	0.17	1.71	0.53	2.091

Step 4: Determine the additional storage volume required.

Additional storage volume required = 2.32 ac-ft – 1.63 ac-ft = 0.69 acre-feet

Since additional storage volume required is greater than 0.10 acre-feet and is not within 2% of the existing volume allocated for the **parcel**, the additional storage volume must be provided. Assuming 0.45 acre-feet of **volume control storage** was provided as part of the **redevelopment** of the **parcel** (1 inch over the **impervious area**), the net volume that is required is 0.24 ac-ft.

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Name of Project: Example 5.11

A. DEVELOPMENT INFORMATION

1) Total parcel area: 11.334 acres
2) Total re/development area on the parcel: 6.00 acres

B. SITE VOLUME CONTROL REQUIREMENTS

1) Existing impervious area of re/development area: 5.10 acres
2) Proposed impervious area of re/development area: 5.40 acres
3) Gross volume control storage required (0.083 X Line B.2): 0.45 acre-feet
4) Do site constraints prevent the use of retention-based practices in full? ☐ Yes ■ No
   If yes, explain and complete B.4.a, B.4.b, and B.4.c for volume control storage allowance:
   ____
   a. Percentage reduction in impervious area (B.2 – B.1)/B.1: __________ %
   b. Volume control storage allowance (Line B.5.a/5%)(0.25)(Line B.3): __________ acre-feet
   c. Volume control treated by a flow through practice: __________ acre-feet
5) Net volume control storage required (Line B.3 – Line B.4.b – Line B.4.c): 0.45 acre-feet
6) Volume control storage provided (must be greater than line B.5): 0.45 acre-feet

C. RELATIONSHIP TO LEGACY SPO

Check one of the following conditions that apply:

■ Development is tributary to existing detention facilities permitted under the SPO

☐ Development is part of the ownership area of an existing permitted parcel under the SPO (Not currently tributary; encumbered under Legacy Schedule L, or otherwise)

☐ Development is tributary to an existing unpermitted detention facility

Legacy Permit Information (approved Schedule D form):

1) Provide Legacy SPO Permit No(s),: XX-XXXX
2) Total "Area of Site" (Legacy Sch. D, Item C-1) : 11.334 acres
3) "Total Contiguous Ownership, including project" (Legacy Sch. A, 6-B) : 11.334 acres
4) "Net Allowable Release Rate" (Legacy Sch. D, Item C-12): 1.183 cfs
5) "Composite Runoff Coefficient (C)" (Legacy Sch. D, Item D-4): 0.88
6) "Required Detention Capacity at actual release rate" (Legacy Sch. D, Item D-5): 3.07 acre-feet

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 1 OF 4

Schedule D-Legacy for Example 5.11 (Page 1 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Unpermitted Existing Facility Information:

7) Tributary area to existing facility: ______ acres
8) Existing release rate (must be less than 0.30 cfs/ac): ______ cfs
9) Existing composite runoff coefficient: ______
10) Verified detention volume capacity (from survey): ______ acre-feet

D. DEVELOPMENT TRIBUTARY TO EXISTING DETENTION FACILITY(S)

Existing Detention Sufficient

1) Original total composite runoff coefficient (C.5) 0.88
2) Proposed composite runoff coefficient (for sub re/development area) 0.89

   If D.2 ≤ D.1, no additional detention volume is required, complete D & proceed to G)
   If D.2 > D.1, proceed to (D.5).
3) Original required detention volume capacity (C.6): ______ acre-feet
4) Verified actual existing detention volume serving proposed development: ______ acre-feet

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

5) Original total composite runoff coefficient (C.5): 0.88
6) Proposed composite runoff coefficient (for sub re/development area): 0.89
7) Permitted release rate for the original facility (C.4): 1.183 cfs
8) Original required detention volume capacity (C.6): 3.07 acre-feet
9) Existing detention volume pro-rated for the sub re/development area (C.6/C.2 * A.2): 1.63 acre-feet
10) Proposed required detention volume capacity (based on C.2): 4.39 acre-feet
11) Proposed detention volume pro-rated for the sub re/development area (D.10/C.2 * A.2): 2.32 acre-feet
12) Verified actual existing detention volume (from survey): 3.07 acre-feet
13) Additional detention volume required†: (D.11 – D.9): 0.69 acre-feet
14) Additional storage volume provided (then proceed to G): 0.45 (Vol Cont) 0.24 (Det.) acre-feet

E. DEVELOPMENT NOT PREVIOUSLY TRIBUTARY TO MWRD PERMITTED DETENTION FACILITY

New Release Rate

1) Cfs/acre for original permit area (C.4/C.2): ______ cfs/acre
2) Release rate for new area (A.2 * E.1): ______ cfs
3) New total release rate required for entire existing system (E.2 + C.4): ______ cfs

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 2 OF 4

Schedule D-Legacy for Example 5.11 (Page 2 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

4) Required detention volume for new development (per Bull. 70 & w/ new release (E.2): __________________acre-feet
5) Required new total detention volume (C.6 + E.4): ___________________________acre-feet
6) Verified actual existing detention volume (per survey):________________________ acre-feet
7) Additional detention volume required† (E.5 – E.6): _________________________ acre-feet
8) Additional storage volume provided (then proceed to G): ____________________ acre-feet

F. DEVELOPMENT TRIBUTARY TO UNPERMITTED DETENTION FACILITY(S)

Existing Detention Sufficient (Use Modified Rational method with TP-40 Rainfall Depths):

1) Original total composite runoff coefficient (C.9): __________________________
2) Original allowable release rate (C.8): __________________________ cfs
3) Original required detention volume capacity (based on C.7): __________________acre-feet
4) Verified actual existing detention volume (per survey): ________________acre-feet
5) Existing impervious area of re/development: ______________________acres
6) Proposed impervious area of re/development: _____________________acres

If F.6 ≤ F.5, no additional detention volume is required, proceed to G)
If F.6 > F.5, proceed to (F.7).

Additional Volume Required (Use Modified Rational method with Bulletin 70 Rainfall Depths):

7) Proposed composite runoff coefficient for re/development area:__________________
8) Allowable release appropriated to proposed re/development (F.2/C.7 *A.2): ___________cfs
9) Required detention volume for proposed re/development: ______________________ acre-feet
10) Existing detention volume pro-rated for re/development area (F.3/C.7 * A.2): ________________________ acre-feet
11) Additional detention volume required †: (F.9 – F.10): _______________________ acre-feet
12) Additional storage volume provided (then proceed to G): ______________________acre-feet

† If additional volume required ≤ 0.10 acre-feet or 2% of total required, no additional volume required. Note, volume control storage provided can be credited toward the required volume

G. EXISTING / PROPOSED DETENTION FACILITY PARAMETERS
(Document existing, provide details and calculations if proposed)
Type of stormwater Detention Volume (check one)

■ Reservoir ☐ Other Specify__________________ ☐ Offsite Facility Location ________________

☐ Parking Lot

1) Actual detention volume provided at HWL (NAVD 88): 3.32 acre-feet
2) Actual release rate at HWL: 1.183 cfs

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 3 OF 4

Schedule D-Legacy for Example 5.11 (Page 3 of 4)

Watershed Management Permit No. XX-XXXX

WMO SCHEDULE D-LEGACY
WATERSHED MANAGEMENT FACILITIES

3) HWL (NAVD 88): 594.00 ft

Type of Stormwater Outlet Control Structure:

4) Type: Sharp-edge Orifice
5) Discharge coefficient: 0.61
6) Diameter: 4.47 in
7) Orifice invert elevation (NAVD 88): 588.90 ft
8) Weir length: 10.0 ft
9) Weir invert elevation (NAVD 88): 594.00 ft

H. UPSTREAM TRIBUTARY AREA AND BYPASS SYSTEMS
(Document existing, provide details and calculations if proposed)

1) Upstream tributary drainage area: N/A acres
   A) Ratio of upstream tributary area to development area: ______
   B) Detention facility drawdown time: ______ hrs
   C) Composite CN for upstream tributary area: ______
   D) Time of concentration for upstream tributary area: ______ minutes
   E) 100-year peak flowrate for upstream tributary area: ______ cfs

2) Describe bypass system type details: ☐ Overflow weir ☐ Restrictor
   Orifice diameter: ______ in Orifice invert elevation: ______ ft (NAVD 88)
   Orifice type and discharge coefficient: ______
   Weir length: ______ ft Weir invert elevation: ______ ft (NAVD 88)

I. CERTIFICATION

The undersigned professional engineer certifies that the design of the stormwater management facilities:

1. Are in accordance with §501.1 of the WMO, and will have no adverse impacts on adjacent and downstream properties;
2. Proposed collection systems and sewers have sufficient capacity to collect and convey the 100-yr site stormwater runoff to the basin and;
3. The bypass system (existing or proposed) is designed with sufficient capacity for emergency overland flow of upstream and onsite areas.

Name John Smith Title Project Engineer

Signature ______ Date 4/28/14

Engineering Firm Smith Engineering

PE SEAL

4/14 SCHEDULE D-LEGACY – WATERSHED MANAGEMENT FACILITIES PAGE 4 OF 4

Schedule D-Legacy for Example 5.11 (Page 4 of 4)

Parcels with Existing Detention not Permitted Under the SPO

Parcels in **combined sewer areas** were not required to provide **detention** under the **SPO**, however, a local ordinance may have required **detention** for these **developments**. Similarly, a local ordinance may have required detention in a **separate sewer area** when the **SPO** did not require it (for example, if the **development** was constructed prior to 1972 and a local ordinance was in place). Therefore, it is possible that **parcels** may have **existing detention facilities** that were never permitted by the **District**. The WMO also makes allowances for the **redevelopment** of these **parcel**s. These allowances are outlined in §505.4 of the WMO.

If the **redevelopment** meets **all** of the following conditions:

- Actual detention volume is verified to meet or exceed the detention volume calculated according to standards set under the **SPO**, and signed and sealed by either a **Professional Engineer** or a **Professional Land Surveyor**;

- Actual release rate from the existing control **structure** is verified to be less than the requirements set under the **SPO**, and the calculations are signed and sealed by either a **Professional Engineer**;

- The **redevelopment** provides treatment of the **volume control storage** as required in the WMO; and

- The **redevelopment** provides adequate capacity to convey **stormwater runoff** to the **existing detention facility** for all storms up to and including the 100-year **storm event**.

Then, the following **redevelopment** allowances may be granted:

- If the **redevelopment's** proposed **impervious area** does not exceed the existing **impervious area**, additional **stormwater** detention volume is not required;

- If the **redevelopment's** proposed **impervious area** exceeds the existing **impervious area**, additional **stormwater** detention volume shall be provided for the **redevelopment**. In such situations, the modified Rational Method using **Bulletin 70** rainfall data may be used to calculate the additional required storage volume. The release rate for the **redevelopment** will be based on a pro-rata share of **redevelopment's** portion of the actual release rate of the control **structure**.

REFERENCES

APT BASS System. "Permeable Paver Cross Section." http://www.advancedpavement.com/ (accessed November 22, 2011).

Burke, C.B, and Burke, T.T. 2008. *Indiana LTAP Stormwater Drainage Manual*.

Chow, V.T. 1959, reissued 1988. Open Channel Hydraulics.

City of Chicago Stormwater Ordinance Manual. 2014. Available at: http://www.cityofchicago.org/content/dam/city/depts/water/general/Engineering/SewerConstStormReq/2014StormwaterManual.pdf

Kane County Technical Reference Manual. Available at: http://www.countyofkane.org/FDER/Documents/waterOrdinances/technicalManual.pdf

Lake County Technical Reference Manual. Available at: http://www.lakecountyil.gov/Stormwater/FloodplainStormwaterRegulations/WDOandTRM/Pages/TechnicalReferenceManual.aspx

Metropolitan Water Reclamation District of Greater Chicago. 1978. *Recommendations for Design of Outflow Control Devices of Stormwater Detention Facilities*.

Natura, Heidi, Conservation Research Institute (CRI). "Root Systems of Prairie Plants." 1995. Available at: http://conservationresearchinstitute.org/

Southeast Michigan Council of Governments (SEMCOG). 2009. *Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers*. Available at: http://semcog.org/Plans-for-the-Region/Environment/Green-Infrastructure

US Department of Agriculture, Natural Resources Conservation Service. 1986. Urban Hydrology for Small Watersheds: Technical Release 55. Available at: http://www.cpesc.org/reference/tr55.pdf

US Department of Agriculture, Natural Resources Conservation Service. 2004. National Engineering Handbook, Part 603 Hydrology. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprdb1043063

US Environmental Protection Agency. 1999. *Storm Water Technology Fact Sheet: Hydrodynamic Separators*. Available at: http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_hydro.pdf

ARTICLE 6: FLOOD PROTECTION AREAS

Introduction

Flood Protection Areas (FPAs) are generally natural topographic and/or vegetated areas that provide water quantity benefits that are important components of **watershed** management. Under the WMO, **FPAs** include **floodplains**, **floodways**, **wetlands**, **wetland buffers**, and **riparian environments**.

FPAs provide a variety of functions, including **sediment** filtering, bank **stabilization**, water/**floodplain** storage and release, and aquifer recharge. In addition, **FPAs** can provide important habitat for wildlife.

FPAs are regulated by state and federal agencies. The **Illinois Department of Natural Resources - Office of Water Resources (OWR**) regulates activities in the **regulatory floodway**. The **Federal Emergency Management Agency (FEMA)** administers the **National Flood Insurance Program (NFIP)** in **regulatory floodplains** and **regulatory floodways**. The **US Army Corps of Engineers (Corps)** regulates waters of the US, including **wetlands**, and to some degree **wetland buffers**, which may also be located within **riparian environments**.

The WMO provides standards for **development** that meet, or in some instances exceed, the State **floodway** requirements as administered by the **OWR** and the **wetland** permitting requirements administered by the **Corps**. WMO regulations do not supersede or replace the authority of the **OWR** or the **Corps** to administer or issue permits for **development** under their jurisdiction. Prior to construction within a **FPA**, applicants must secure all appropriate permits or approvals from these agencies. For certain activities in the **floodway** and **wetlands**, the **OWR** and the **Corps** have issued Statewide and Regional Permits. Where **developments** meet the general or specific conditions of Statewide or Regional Permits, the appropriate documentation must be submitted to the **District** or an **authorized municipality** prior to issuance of a WMO permit.

Additionally, while the WMO meets, and in some instances exceeds, the minimum technical requirements of the **NFIP** for **development** in the **floodplain**, not all administrative requirements are specifically addressed. For example, the requirement and standard for elevating a **building** in the **floodplain** that has been substantially improved is included in the WMO. However, the administrative requirement to determine if an improvement is a **substantial improvement** is the responsibility of the **NFIP** community and may include activities that do not affect **stormwater**, such as internal remodeling or exterior improvements such as siding and windows.

<u>Note</u>: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

REQUIREMENTS FOR FLOODPLAINS AND FLOODWAYS (§601)

Introduction

Floodplain management is a critical component of **watershed** management and is defined as the regulation of activity or **development** in the **floodplain**. For the purposes of the WMO, the **floodplain** is the area adjacent to and including a body of water where ground surface elevations are at or below the **100-year flood elevation**. The 100-year **flood** event represents a **flood** that has a one percent chance of occurring in any given year, and is also known as the "1% annual chance **flood**" or "**base flood**." The **100-year flood elevation** is commonly referred to as the **Base Flood Elevation** (**BFE**).

Floodplain management consists of the regulation of **floodways**, **flood** fringe areas, and **site-specific** or **depressional storage** areas. **Floodplain** standards define appropriate activities allowed in the **floodplain** and describe how these activities must be constructed to protect people and property from **flood** damage.

The WMO establishes general standards for **development** activities in the **floodplain**. The WMO in §601.1 states that **development** within **floodplains** shall not*:*

1. "Result in any new or additional expense to any **person** other than the applicant for **flood** protection or for lost environmental stream uses and functions;

2. Increase **flood** elevations by more than 0.1 ft or decrease **flood** conveyance capacity upstream or downstream of the area not under the **ownership** or control of the applicant;

3. Increase **flood** velocities by more than 10% or result in an impairment of the hydrologic and hydraulic functions of streams and **floodplains** unless a **water resource benefit** is realized;

4. Violate any provision of this **Ordinance** either during or after construction; and

5. Unreasonably or unnecessarily degrade surface or ground water quality."

All activities in the **floodplain** that meet the WMO definition of **development** require a **Watershed Management Permit**. The WMO defines **development** as:

> "Any human-induced activity or change to real estate (including, but not limited to, grading, paving, excavation, dredging, fill, or mining; alteration, subdivision, change in land use or practice; **building**; or storage of equipment or materials) undertaken by private or public entities that affects the volume, flow rate, drainage pattern, or composition of **stormwater**, or the **substantial improvement** of an existing **building** in a **Special Flood Hazard Area** (**SFHA**). The term **development** shall include **redevelopment** and shall be understood to not include **maintenance**."

The WMO and the National Flood Insurance Program

National Flood Insurance Program Eligibility (WMO §206)

1. The WMO does not repeal any municipal ordinance or resolution passed in order to establish eligibility for the National Flood Insurance Program (NFIP).
2. The WMO is not intended to supplement, replace, or remove any responsibility that a municipality may have to maintain eligibility and good standing in the NFIP. Proper administration and enforcement of the NFIP within participating municipalities is a requirement of the NFIP.
3. Floodplain requirements meet or exceed the NFIP requirements for development as defined by Article 6 of the WMO.

   Note:

   Refer to the actual language contained in the NFIP Floodplain Management Regulations at Title 44 Code of Federal Regulations (CFR) Part 59 and 60 for municipal requirements for the administration and enforcement of the required NFIP minimum criteria.

Identifying Regulatory Floodplain

The **National Flood Insurance Program** (**NFIP**) was established in 1968 to promote responsible **floodplain** management to reduce future **flood** damages and to offer **flood** insurance to individual property **owners**. The **Federal Emergency Management Agency** (**FEMA**) began publishing **Flood Insurance Rate Maps** (**FIRMs**) to show the locations of **flood** zones in relation to specific properties. Since **FEMA** began publishing **FIRMs** in the early 1970's, the maps have been updated and revised to include the various **flood** studies that have been completed over the years. At the time of this publication, the most recent **FIRMs** for **Cook County** have a revision date of August 19, 2008. Both historical and effective **FIRMs** can be viewed on-line through **FEMA's** website at: https://msc.FEMA.gov/. A complete listing of all **FIRM** maps in **Cook County** is provided in Appendix B of the **TGM**.

FIRMs provide the locations of various **flood** zones in relation to specific properties. Each **FIRM** contains a legend that designates the different types of **flood** zones and their characteristics. The maps also include other useful information such as the limits of the **regulatory floodway**, municipal boundaries, and benchmarks. The **regulatory floodplain** is shown on the **FIRM** as a **SFHA**, and in Illinois all **SFHAs** have Zone "A" designations. **Flood** zones with the "A" designation are areas with a one percent chance of **flooding**, however, a **BFE** may or may not be established by **FEMA**.

A listing of applicable Zone A **floodplains** is shown in Table 6-1. Any Zone A areas shown on a **FIRM** are considered to be **regulatory floodplain** areas. Descriptions of other common **FIRM** zones are also included in the table.

Table 6-1. FIRM Zone Descriptions

FIRM Zone	Description
AE, A1-A30	Areas with a 1% annual chance of **flooding** and a 26% chance of **flooding** over the life of a 30-year mortgage. In most instances, **BFEs** derived from detailed analyses are shown at selected intervals within these zones.
AH	Areas with a 1% annual chance of shallow **flooding**, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of **flooding** over the life of a 30-year mortgage. **BFEs** derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream **flood** hazard areas and areas with a 1% or greater chance of shallow **flooding** each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of **flooding** over the life of a 30-year mortgage. Average **flood** depths derived from detailed analyses are shown within these zones
A	Areas with a 1% annual chance of **flooding** and a 26% chance of **flooding** over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or **BFEs** are shown within these zones. Since no **BFE** has been established, the applicant must determine an elevation using a **site**-specific **floodplain** study by a **professional engineer** using appropriate hydrologic and hydraulic models. This is discussed in further detail in this document.
AR	Areas with a temporarily increased **flood** risk due to the **building** or restoration of a **flood** control system (such as a levee or a **dam**). Mandatory **flood** insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the **structure** is built or restored in compliance with Zone AR **floodplain** management regulations.
A99	Areas with a 1% annual chance of **flooding** that will be protected by a Federal **flood** control system where construction has reached specified legal requirements. No depths or **BFEs** are shown within these zones.
X	Areas outside the 1-percent annual chance **floodplain**, outside of the 1% annual chance sheet flow **flooding** where average depths are less than 1 foot, and outside the areas of 1% annual chance stream **flooding** where the contributing **drainage area** is less than 1 square mile, or areas protected from the 1% annual chance **flood** by levees. No **BFEs** or depths are shown within these zones. **Flood** insurance is not required in these zones and no **floodplain** permit is required from MWRD.
D	Areas in which **flood** hazards are undetermined, but possible.

The AE, A1-A30, AH, AO, A, AR, and A99 areas described in the table above are often referred to as the 100-year **floodplain**. Following the passage of the **Flood** Disaster Protection Act of 1973 and the National **Flood** Insurance Reform Act of 1994, the purchase of **flood** insurance is mandatory for any federally backed mortgage on a **building** located in a **SFHA**.

Regulatory Floodplain and BFE Determination

Although the limits of the **regulatory floodplain** are shown on a **FIRM**, a more accurate location of the **regulatory floodplain** is possible by delineating the **BFE** on the project-specific topography. Because **FIRMs** round the **BFE** to the nearest whole foot, it is necessary to consult the **Flood Insurance Study (FIS)**, which provides **flood** profiles to the nearest 0.1 foot. Therefore, to accurately identify the limits of the **regulatory floodplain** on a project **site**, a combination of the information provided on the **FIRM** and in the **FIS** must be used.

In addition to the **flood** profiles, the **FIS** contains other useful information such as the hydrologic and hydraulic computer models used in **floodplain** studies, **floodway** data tables, and **flood** profiles. It also contains an inventory of any **Letters of Map Change (LOMC)** that have been issued by **FEMA** for the County. The **Cook County FIS** can be viewed on-line through **FEMA's** website using the following link: https://msc.FEMA.gov/.

Map zones are designated on the **FIRM** and are described in the map's legend. As stated in the WMO, the determination of the **BFE** in **SFHAs** shown on the **FIRM** associated with the effective **FIS** shall be determined for:

1. AE Zones by using the 100-year profile at the **development site**, which is taken from the **FIS**;

2. AH Zones by using the elevation noted on the applicable **FIRM**;

3. AO Zones by using the **highest adjacent grade** plus the depth number shown on the applicable **FIRM**, or two feet above the **highest adjacent grade** if no depth number is provided; and

4. Areas shown as A Zones on the effective **FIS**, a **BFE** shall be determined by a project-specific **floodplain** study approved by the **District**. This study shall be approved by **OWR** in cases where both:

    a. The **drainage area** is one square mile or greater; and

    b. The **development** is associated with a permit that will be issued by **OWR**.

When a known **flood** hazard is not shown on the **FIRM** as an **SFHA**, the **District** or an **authorized municipality** may require the applicant to perform a project-specific **floodplain** study to determine the **BFE**. For these cases, the requirements outlined in (4) above will also apply.

Project Specific Floodplain Studies

The **District** may require a project-specific **floodplain** study to determine the project-specific **100-year flood elevation** (§601.5). The reasons for a project-specific **floodplain** study may include, but are not limited to, the following:

1. Areas that are mapped as **SFHAs** on the **FIRM** but contain no associated **flood** elevation. The project-specific study will provide both the limits of the **floodplain** and **floodway** and will serve as best available information until a **regulatory floodplain** and **floodway** are established. If the **tributary area** to the **site** is one square mile or greater, the study shall also require approval from **OWR** or their designee;

2. Areas that are known to **flood**, but where there is no **SFHA** shown on the **FIRM**. The project-specific **floodplain** study will be used to determine the extent of the **floodplain** to ensure that new **structures** are built to withstand **flooding** and to ensure that no

damage is caused to existing **buildings** as a result of new **development**; and

3. Areas where the **floodplain** maps are known to incorrectly delineate the **floodplain** elevations.

For the above situations, the project-specific **floodplain** studies need to be approved by **OWR** in cases where both:

1. The **drainage area** is one square mile or greater; and

2. The **development** is associated with a permit that will be issued by **OWR**.

Also, when a project-specific **floodplain** study is required, hydraulic and hydrologic analysis must be completed utilizing an approved methodology such as those outlined in §601.6 of the WMO, including:

1. TR-20, HEC-1, or HEC-HMS hydrologic model; and

2. HEC-2 or HEC-RAS hydraulic model.

Hydrologic Models
TR-20 is a DOS-based hydrologic modeling computer program that was developed by the Soil Conservation Service (now named the **Natural Resources Conservation Service**). TR-20 is a physically-based **watershed** scale **runoff** event model that is based on the Soil Conservation Service (SCS) Technical Release (TR-55) methodology. It computes direct **runoff** and develops hydrographs resulting from any synthetic or natural rainstorm. Developed hydrographs are routed through stream and valley reaches as well as through reservoirs. Hydrographs are combined from tributaries with those on the main stream stem. Branching flow (diversions) and baseflow can also be accommodated. The TR-20 hydrologic modeling software is available for download on-line at:

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/null/?cid=stelprdb1042924

A windows-based version of the software (Win TR-20) has also been developed and can be downloaded on-line at:

https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/hydrology/

HEC-1 and HEC-HMS hydrologic modeling computer programs were developed by the **Corps**. These programs offer the same capabilities as TR-20, but provide additional methodologies for the generation of **runoff** and hydrograph routing. HEC-HMS is the windows-based version of the software and supersedes the original DOS-based HEC-1 software. Both programs are acceptable to use in hydrologic analyses, however, HEC-1 and HEC-HMS must be used in conjunction with the SCS **runoff** method. The programs are available for download on-line at:

http://www.hec.Corps.army.mil/software/.

Hydrologic Modeling Procedure
If flowrates for a **waterway** have been established in the **FIS**, or have been certified by **OWR**, the applicant may use these flowrates instead of performing a detailed hydrologic analysis of the **waterway**. If there are no established flowrates, or if **watershed** conditions have changed which render the established flows obsolete, then the applicant must perform a detailed hydrologic analysis to define flowrates through the project **site**. Utilizing one of the approved hydrologic models from the previous section, a hydrologic analysis must be performed using the following guidelines:

- The modeling should assume an average Antecedent Moisture Condition (AMC) of 2 for the **watershed**.
- The **Bulletin 70** rainfall depths provided in Table 5-6 of the **TGM** must be used in conjunction with the appropriate Huff rainfall distributions (Table 5-5).
- The analysis should include the 1-, 2-, 3-, 6-, 12-, 18-, 24- and 48-hour storm durations to determine the critical storm duration for the **watershed**.
- Where available, the hydrologic model should be calibrated to gaged data for the **watershed**.

Hydraulic Models
Both HEC-2 and HEC-RAS are water surface profile programs developed by the **Corps**. The HEC-RAS software, which performs one-dimensional steady and unsteady flow river hydraulic calculations, supersedes the DOS-based HEC-2 software, which calculated water surface profiles for one-dimensional, steady flow conditions. These programs compute water surface profiles for both subcritical and supercritical flow conditions, and have the ability to analyze the effects of bridges, culverts, flow obstructions, inline weirs, lateral **structures** and other **structures** that influence river hydraulics. These models were also designed for applications in **floodplain** management and **flood** insurance studies to evaluate **floodway** encroachments. Both HEC-2 and HEC-RAS are acceptable hydraulic modeling software, and are available for download on-line at:

http://www.hec.Corps.army.mil/software/

Since technologies are constantly improving and new models are being developed, there may be additional methods available for modeling purposes. Alternative methodology must be approved by the **District** and by **OWR**, as applicable, prior to submitting for a permit.

Hydraulic Modeling Procedure

By utilizing either established flowrates or flowrates obtained through a detailed hydrologic analysis, the water surface profiles for a **waterway** can be established by using one of the hydraulic models approved by the WMO. An existing (without project) conditions hydraulic model should be developed to determine the limits of the **floodplain** through the project **site**. A proposed (with project) conditions hydraulic model should also be developed to determine the impacts (if any) that the proposed project has on **flood** elevations.

Existing (Without Project) Conditions Model

A hydraulic model is developed based on project-specific survey data, which includes channel cross-sections and all hydraulic **structures**. The cross-sections should be drawn parallel to each other and perpendicular to **flood** flow, and should also extend beyond the limits of the 100-year **floodplain**. Roughness coefficients (Manning's n values) for the channel and overbank areas of each cross-section must be defined based on the types of vegetation and land use. The hydraulic model requires the user to define a downstream boundary condition, which is either a known water surface elevation (preferable) or the normal depth based on the average slope of the channel. The downstream boundary condition should be located sufficiently downstream so that it does not affect the onsite **flood** elevations (in most cases this will be less than 500 feet downstream). If the subject **waterway** is influenced by the backwater of a receiving stream, the downstream boundary condition should be adjusted accordingly.

The results of this model will serve as the existing (without project) conditions. This hydraulic model can become the regulatory model if it is approved by the community, **OWR** (if required), and **FEMA**.

Proposed (With Project) Conditions Model

This hydraulic model is developed based on the effects of the proposed **development** on the **waterway**. The cross-section geometries should reflect any **floodplain** cut or fill that results from the proposed **development**. If the **development** proposes roadway crossings, the new hydraulic **structures** should be included in the hydraulic model. The channel and overbank roughness coefficients should be adjusted to account for any changes to the onsite vegetation and land use. The proposed conditions model will determine the impacts that the proposed project has on the existing hydraulic conditions.

<u>Letters of Map Change (LOMC)</u>

The WMO requires all applicants to review the current **FIRM**, including any **LOMCs**, to determine if a **regulatory floodplain** is within the **development site**. **FIRMs** can be updated at any time by **FEMA**, and only **FEMA** can issue a revision to a **FIRM**. Because each **LOMC** is not necessarily updated on the **FIRMs**, the applicant must review all **LOMCs** issued in their area of **interest** to verify they are using the most up-to-date **FEMA** approved **flood** elevations. For this reason, the WMO states in §601.3:

*The current versions of the maps adopted and published by **FEMA** for regulation under the **NFIP** together with any amendments, additions, revisions, or substitutions adopted and published by **FEMA** at any time in the future are hereby referred to, adopted, and made part hereof, as if fully set out in the WMO.*

LOMCs can be viewed on-line from **FEMA**'s website at: https://msc.FEMA.gov.

Because **FIRMs** play such a critical role in effective **floodplain** management, the limits of the **SFHAs** are constantly being updated to reflect new and better information. Communities, engineers, homeowners, and developers may find it necessary to revise the **FIRMs** to reflect new information. A description of each type of **LOMC** is provided below.

Letter of Map Amendment (LOMA)
A **LOMA** is required when a single **structure** (or multiple **structures**) is inadvertently shown in the **SFHA**, but is built on natural high ground that is equal to or above the **BFE**. Certification by a **Professional Engineer** or **Professional Land Surveyor** is required so that the lowest adjacent grade (LAG) of the **structure** is at or above the **BFE**. When **FEMA** issues a **LOMA**, the **structure** is removed from the **SFHA**, but the **FIRM** is not actually revised to reflect it.

Letter of Map Revision (LOMR)
To officially revise the **regulatory floodplain** and **floodway** boundaries, a **LOMR** must be issued by **FEMA**. There are several cases that may require a **LOMR**, with the most common being:

- A **flood** study is developed for a Zone A (unstudied) area;
- A new **flood** study is developed that revises the regulatory **flood** study; or
- A **flood** control facility, such as a reservoir or levee, is constructed that revises the regulatory flowrates/**flood** elevations

When **FEMA** issues a **LOMR**, both **flood** elevations and **SFHA** boundaries are revised, but only for the affected area.

Physical Map Revision (PMR)
LOMR requests typically involve small areas of revisions, but if a large area of revision is requested, such as for an entire **watershed** study, it is easier for **FEMA** to re-issue the entire **FIRM** panel(s). When a PMR is issued, **FEMA** will physically reprint one or more **FIRM** panels that cover the area of revision.

LOMR-F
A **LOMR-F** request is to remove a **structure** or area of land from the **SFHA** through the placement of fill. The **LOMR-F** officially revises the limits of the **SFHA** based on the fill area, but it does not revise **flood** elevations or **floodway** boundaries (since fill is not allowed in the **floodway**).

CLOMR

A **CLOMR** is only required for proposed projects that either: (1) increase **flood** elevations by more than 0.1 foot, or (2) revise the **regulatory floodway** boundary. The purpose of the **CLOMR** is to verify that, if a proposed project is constructed as designed, it will revise **flood** elevations and/or **floodway** boundaries. Since a **CLOMR** is conditional, there is no map revision when it is issued. The official map revision would occur after as-builts are submitted and **FEMA** issues a **LOMR**.

In order to meet the minimum requirements of the **NFIP** and the **OWR floodway** regulations, the WMO requires certain **LOMCs** to be obtained prior to construction in the **FPA**:

1. All **CLOMR**, **LOMR**, and **LOMR-F** applications must have the approval of the governing **municipality** and must be submitted to the **District** concurrently with the application to **FEMA** (§602.15);
2. Filling, grading, dredging, excavating, or other proposed **development** within the **regulatory floodplain** is prohibited if the proposed activity will create an increase to the **FIS** effective **BFE** or a modification to the **regulatory floodway** boundary, until a **CLOMR** is issued by **FEMA** and a **floodway** construction permit is issued by **OWR** (§602.16); and
3. If a **LOMR** is required by **FEMA**, then **building** construction shall not take place until the approved **LOMR** is received (§602.17).

<u>Examples for Determining the BFE, the Flood Protection Elevation (FPE), and Limits of the Regulatory Floodplain</u>

<u>*Example 1: SFHA Shown on FIRM and BFE Established*</u>

BFE = **100-year flood elevation** taken from **FIS flood** profile

FPE = **BFE** + 2 feet

Regulatory Floodplain = **BFE** delineated on **site**-specific topography

<u>*Example 2: SFHA Shown on FIRM, BFE Determined in the FIS and an LOMC Issued*</u>

BFE = **100-year flood elevation** taken from issued **LOMC**

FPE = **BFE** + 2 feet

Regulatory Floodplain = **BFE** delineated on **site**-specific topography

<u>*Example 3: SFHA Shown on FIRM and No BFE Established*</u>

BFE = **100-year flood elevation** from project-specific **floodplain** study

FPE = **BFE** + 2 feet

Regulatory Floodplain = **BFE** delineated on **site**-specific topography

<u>Example 4: SFHA NOT Shown on FIRM, No BFE, and District Requires a Project-Specific Study</u>

BFE = **100-year flood elevation** from project-specific **floodplain** study

FPE = **BFE** + 2 feet

Regulatory Floodplain = **BFE** delineated on **site**-specific topography

In this situation it is important to note that all WMO and **NFIP** requirements apply throughout the **SFHA**.

Identifying Regulatory Floodway

The **floodway** is the portion of the **floodplain** adjacent to a stream or watercourse that is needed to convey the **base flood** without cumulatively increasing the water surface elevation more than 0.10 foot. Water within the **floodway** is often the deepest and swiftest. Protecting this area is critical because **development** within it may result in potentially damaging increases in **flood** stage and **flood** velocities. In accordance with Illinois law, **development** in the **regulatory floodway** is limited to **appropriate uses** and is under the jurisdiction of the **OWR**.

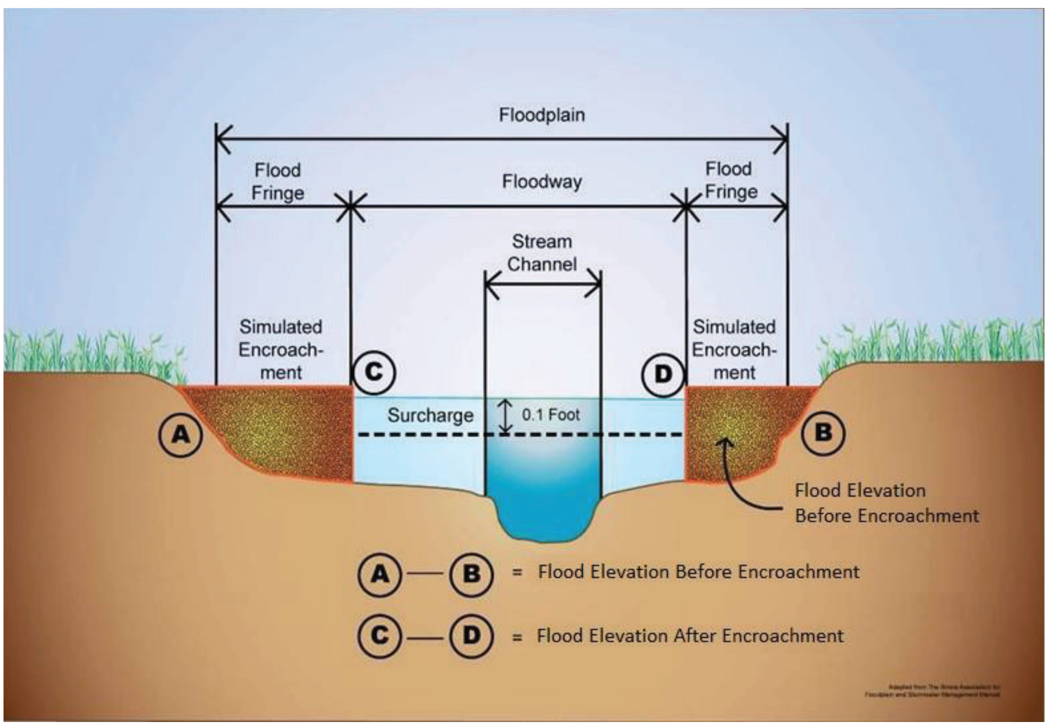


Figure 6.1. Floodplain, Floodway, and Stream Channel Cross-section

The limits of the **regulatory floodway** must be determined for each **development site**. Designated **regulatory floodways** are shown as cross-hatched areas on the effective **FIRM**. To locate the **regulatory floodway** boundary on a project **site**, the **floodway** should be scaled off the **regulatory floodway** map and located on a **site** plan using reference marks common to both maps. These reference points should be fixed objects common to both the **floodway** map and the **site** plan such as roadways, bridges, and section lines. Unlike the **regulatory floodplain**, which is delineated based on project-specific topography, the **regulatory floodway** widths for a project **site** should be identical to the **regulatory floodway** widths shown on the **FIRM**. Where interpretation is needed to determine the exact location of the **regulatory floodway** boundary, the **District** or an **authorized municipality** should be contacted for the interpretation.

In some instances, a cross-section from the **FIS** may be located on the property. For that specific location, it is not necessary to scale the **floodway** limits. The applicant may refer to the **Floodway** Data Tables found within the **FIS**. The cross-section number should be determined from the **FIRM** and then located within the **FIS**.

<u>Designating a Regulatory Floodway</u>

The **floodway** is established using the hydraulic computer model that was used to establish the **floodplain**. The **floodplain** is artificially encroached upon until a certain threshold in reached. Per **OWR** Part 3708 Rules, encroachments are made to the **floodplain** until one of the following criteria is met:

- 0.10-foot increase in the **100-year flood elevation**;
- 10% reduction in storage volume; or
- 10% increase in flow velocities.

When one of these thresholds is met, the **floodway** boundaries have been established. Figure 6.1 illustrates the encroachment of a **floodplain** to define the **floodway**.

Regulatory Floodway Not Designated

The **FIRMs** may show **SFHAs**, but the **floodway** may not be designated or depicted. This is also the case for those projects where no **SFHA** is defined, but a **site**-specific **floodplain** study is required. If a **floodway** has not been designated, requirements are based on the **drainage area** of the **development site** and upstream areas:

1. If the **drainage area** is greater than one square mile to any portion of the **site**, **regulatory floodway** is determined to be the limits of the **regulatory floodplain** (§601.7.A). All provisions related to **regulatory floodway**, with the exception of the **appropriate use** criteria, would apply.

2. If **floodplain** is not designated on the **Cook County FIRM** but the tributary **drainage area** is greater than one square mile to any portion of the **site**, the applicant is required to complete a **site**-specific **floodplain** study to establish the 100-year **floodplain** through the **site**. **OWR** concurrence would be required for the **site**-specific **floodplain** study, however, it is not necessary for the applicant to designate the **floodway**. The provisions referenced in (1) above would apply.

3. If the **floodway** is not designated on the **Cook County FIRM** and the tributary **drainage area** to all portions of the **site** is less than one square mile, **floodway** designation is not required (§601.7.B); only **floodplain** provisions of the WMO would apply.

Re-Designating a Regulatory Floodway

Flood elevations generated by the regulatory model must first be duplicated before updated data is input into the model to reflect the existing conditions. The **flood** profiles, flows, and **floodway** data in the **regulatory floodway** study must be used for analysis of the regulatory conditions. If the study data appears to be in error or conditions have changed, the **OWR** or its designee shall be contacted for approval and concurrence on the appropriate existing conditions data to use. Once the output of the regulatory model has been duplicated to within 0.10 foot of the regulatory profile, revisions should be input to reflect the modified-existing conditions.

Duplicate Effective Model

Whether or not a revision to the **regulatory floodway** conditions is desired, the first step is to duplicate the regulatory profile using the same hydraulic model. Data input into the duplicate model should be identical to the data generated by the regulatory profile. It is not necessary to duplicate the entire regulatory profile but the applicant should start the profile at least four cross-sections downstream of the project **site**. Once the input from the regulatory model has been duplicated, the output of the duplicate model should be verified against the output of the regulatory model. A copy of the regulatory profile should be submitted along with the duplicate model run as part of the permit application package. The discharges from the regulatory model shall be used except where the **District** or an **authorized municipality** requires new discharges. The necessity for new discharges will depend on the correlation between the existing conditions profile, the regulatory profile, and the magnitude of the impacts on the profile due to the project. If the existing conditions profile is calculated to be lower than the regulatory profile, the effects of lost storage must be analyzed and the new hydrologic analysis must reflect the future land use. The applicant may contact the **District** or an **authorized municipality** for an opinion on the suitability of the regulatory discharges. New discharges shall be developed based on the methodologies outlined in Article 5 of the **TGM**. Where there is a designated **floodway** mapped, but there is no computer model available, the engineer should consult the **District** about how to proceed with the specifics of modeling the existing conditions. Whenever new discharges are determined, they should be submitted to the **OWR** for concurrence. The certified discharges form is available on-line through the **OWR**'s website at:

http://www.dnr.illinois.gov/WaterResources/Documents/DischargeCertification_Live_Form.pdf

Corrected Effective Model

Once the duplicated model has been prepared and is operational, the model must be updated to create a model based upon the existing conditions, in order to do a comparison against the proposed conditions hydraulic model. Cross-sections should be added to the effective model where it is appropriate to add them for both the existing and with project hydraulic analyses. The existing conditions model should include all corrections to the regulatory profile and should be modeled with attention to areas of ineffective conveyance. The applicant is responsible for all existing field conditions within the **watershed** which may affect the existing conditions hydraulic model. These areas can be maintained in the model for storage volume and area calculations by inputting an artificially high n-value for these areas (such as 99). This will cause the computer model to treat these areas as ones of ineffective flow, but the cross-sectional area is still maintained for the area and volume calculations. Ineffective flow areas should be clearly annotated on the plans and cross-sections.

The existing conditions profile must tie in to the regulatory profile to within 0.5 feet, based on **FEMA** requirements, upstream and downstream of the project reach. Where it is not possible to meet the regulatory profile, a new **hydrology** study will need to be prepared.

With Project Conditions Model

The with project conditions model will use the same regulatory discharges and cross-section locations as the regulatory conditions model but will reflect the **development** on the **site**. The applicant should first run the model using the with project topography with the fixed encroachments set at the existing condition. If the conveyance, storage, and travel time are maintained and the **flood** stages are not increased, the with project **floodway** will be allowed if it does not differ from the existing conditions **floodway**. If these conditions are not yet met, there are two options: (1) to revise the design to meet the criteria of the WMO, or (2) to develop a new **floodway** that meets the WMO definition and obtain a **LOMR** from **FEMA**, revising the **regulatory floodway**.

The **regulatory floodway** may be re-designated by the applicant, provided that approvals are received from **FEMA** and the **OWR**. For all designated **floodway**s, approval of the re-designation shall be required by **FEMA** through a **CLOMR** and **LOMR**. **FEMA** requires **OWR** concurrence whenever the **tributary area** is greater than one square mile.

REQUIREMENTS FOR DEVELOPMENT WITHIN THE FLOODPLAIN (§602)

Introduction

For the purposes of the WMO, the **floodplain** is the area adjacent to and including a body of water where ground surface elevations are at or below the **100-year flood elevation**. The WMO §602 provides standards for **development** within the **floodplain**. The standards incorporate the minimum requirements of the **OWR** for activities within the **regulatory floodway** and the technical standards of the **NFIP**. Activities in the **regulatory floodway** are limited to **appropriate uses** of the **floodway**.

FPE Determination

The WMO (§601.9) specifies that the **Flood Protection Elevation** (**FPE**) for the **development site** is two feet above the highest **100-year flood elevation** as determined by:

1. The **BFE** associated with the effective **Cook County FIS**, including any **Letter of Map Change (LOMC)** that has been issued by **FEMA**; and

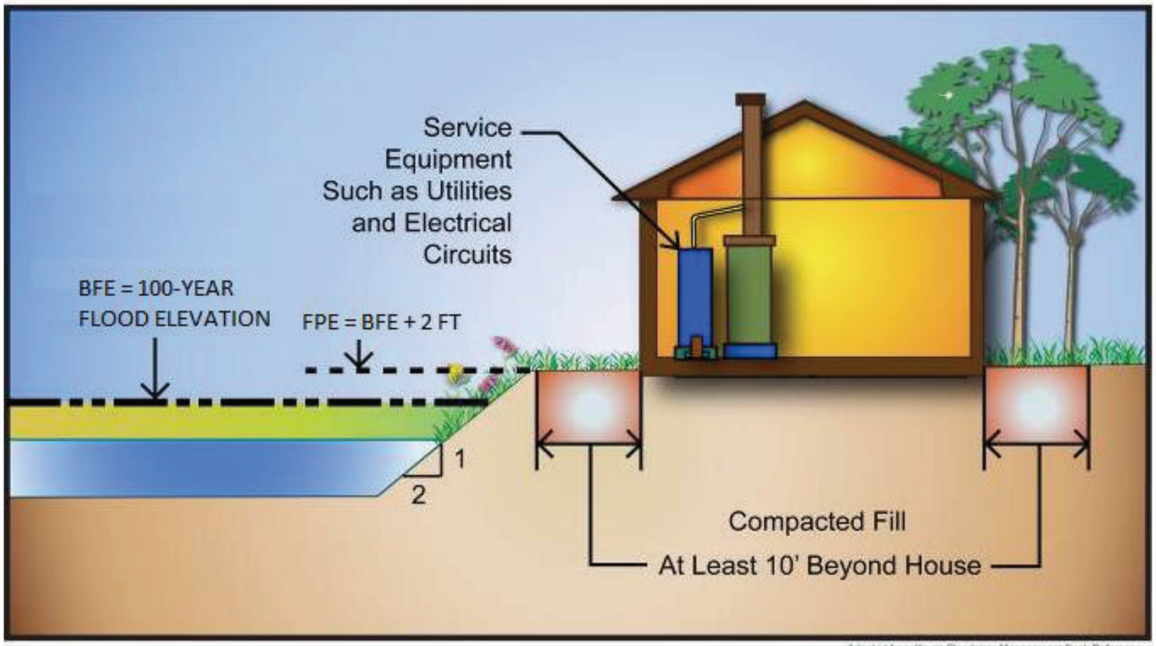
2. The project-specific **100-year flood elevation** developed in §601.5.

The **FPE** must be determined for all **sites** with **floodplain** areas located on the **site** or adjacent to the **site**. **Buildings** located in a **floodplain** must be elevated to the **FPE** (§602.2) and **buildings** adjacent to a **floodplain** must be elevated or otherwise protected (via **floodproofing**) to the **FPE** (§502.14). The two feet of elevation is added to the highest **100-year flood elevation** to provide a factor of safety for **floods** greater in magnitude than a 100-year event. It should be noted that projects with multiple **SFHAs** may have more than one **FPE** for the **development**.

This factor of safety is the last line of defense for protecting **buildings** and **structures** from **flood** damages. Since the **FPE** defined by the WMO goes above and beyond the **NFIP** requirement of elevating **buildings** to the **BFE**, it will also lower insurance premiums for **structures** that carry **flood** insurance.

All usable space in new **buildings** and additions to existing **buildings** in a **floodplain** must be elevated to at least the **FPE** either on fill or by structural elevation. Additionally, all usable space for **substantial improvements** to existing **buildings** in a **regulatory floodplain** must be elevated to at least the **FPE**. It is acceptable for the floor of an attached garage to be elevated only one foot above the **BFE**, provided that the entry door threshold and other openings are elevated to the **FPE** by either fill or by structural elevation. This concept is illustrated in Figure 6.3.

As outlined in the **TGM**, a **basement** is only allowable if a **Letter of Map Revision Based on Fill** (**LOMR-F**) effectively removes the lot from the **floodplain**. All electrical, heating, ventilating, plumbing, and air conditioning equipment must also be elevated to at least the **FPE**. All **structures** that are not **buildings** must be constructed at or above the **FPE** or otherwise protected to the **FPE** from **flood** damage.



Adapted from Illinois Floodplain Management Desk Reference

Figure 6.2. BFE, FPE, and Compacted Fill Cross-section for Structure in the Floodplain (Assumes No LOMR-F)

<u>Building Protection</u>

The **FPE** determined in §601.9 applies to all **structures** located in the **floodplain**. Understanding the definitions of **structures**, **buildings**, usable space, and **accessory structures** is important to understand when the WMO requirements apply.

Structures are defined by the WMO as:

> *Anything that is erected or constructed on or below ground including, but not limited to, **buildings**, **manufactured homes, accessory structures**, fences, sheds, tanks, **dams**, sewers, constructed channels, **outfalls**, parking lots, driveways, roads, sidewalks, and concrete patios.*

Buildings are defined by the WMO as:

> *A **structure** that is constructed and is enclosed by walls and a roof, including **manufactured homes**. This term does not include **accessory structure**s.*

Accessory Structure is defined by the WMO as:

> *A detached, non-habitable **building** without sanitary facilities that is an accessory to an existing **building** and that is less than 500 square feet in area. **Accessory structures** include, but are not limited to, garages and sheds.*

Usable Space can be defined as:

> *Enclosed space used for dwelling, storage, utilities, or other beneficial purposes*

*including, but not limited to, **basements** and attached garages.*

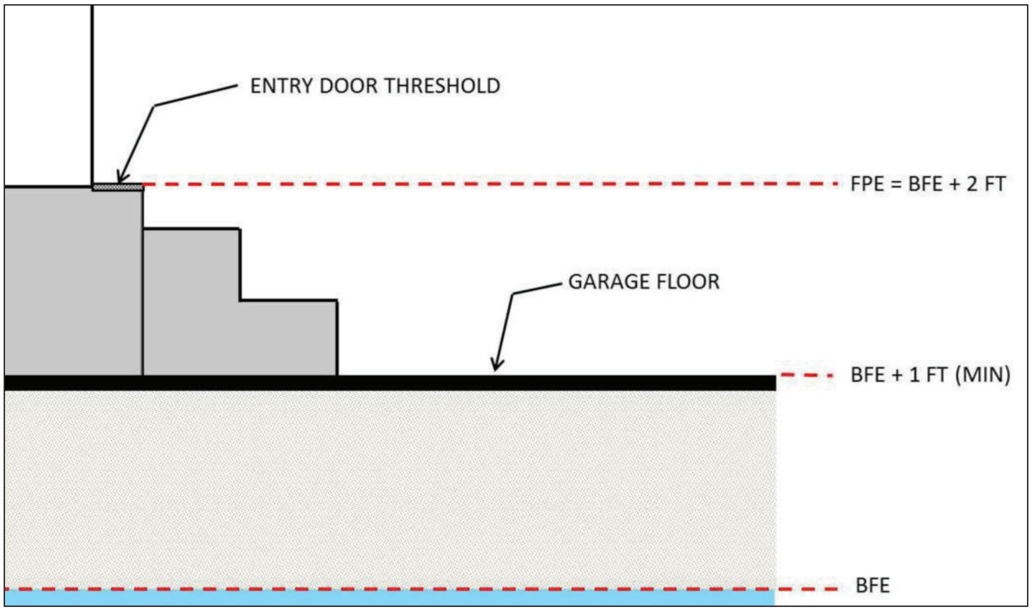


Figure 6.3. BFE and FPE for Structures with Attached Garages

<u>New and Existing Buildings</u>

New **buildings**, additions to existing **buildings**, or **substantial improvements** to existing **buildings** within the **regulatory floodplain** but outside the **regulatory floodway**, that have their **lowest floor** below the **BFE**, must comply with the following:

- The lowest adjacent grade to the foundation must be at or above the **BFE** for a minimum distance of 10 feet beyond the outside face of the **structure** for **buildings** without **basements**;
- The lowest adjacent grade to the foundation must be at or above the **BFE** for a minimum distance of 20 feet beyond the outside face of the **structure** for **buildings** with **basements** (see Figure 6.4);
- The lowest opening in the foundation wall must be at or above the **FPE**;
- **Compensatory storage** per §602.9 and §602.10 must be provided;
- It must be demonstrated that a **building** and **building site** are reasonably safe from **flooding** per design requirements in Technical Bulletin 10-01 issued by **FEMA** (available at http://www.FEMA.gov/media-library-data/20130726-1511-20490-3169/tb1001.pdf); and
- A **LOMR-F** must be obtained if the **building site** is in the **regulatory floodplain**.

If the **site** of a proposed **building** within a **development site** is elevated by fill such that **FEMA** will provide a **LOMR-F**, then a **basement** can be constructed below the **BFE**. This is an allowable practice since the **LOMR-F** effectively removes the area from the **floodplain**, and therefore the **NFIP** requirements are no longer applicable to **development** on this land.

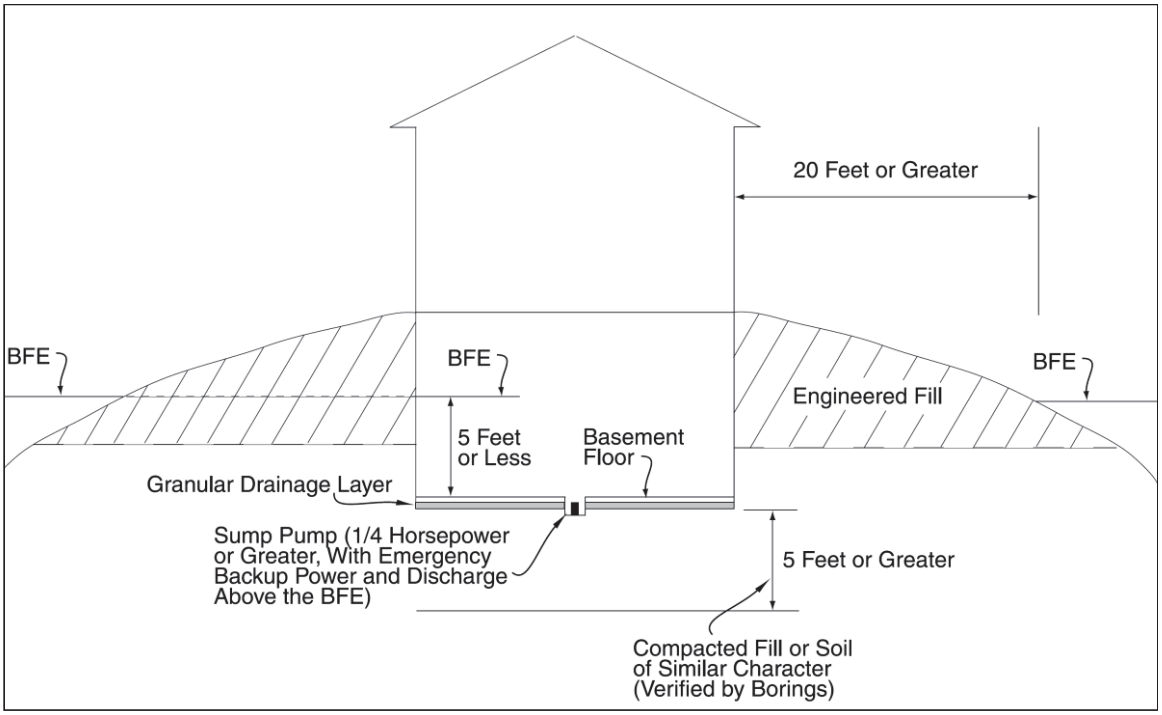


Figure 6.4. BFE and Setback Distance for Buildings with Basements (FEMA, 2001)

The WMO contains additional requirements for **development** in the **floodplain** (§602.12). New **structures** that are elevated, existing **structures** that are **floodproofed**, or **substantial improvements** shall:

A. Be anchored to prevent flotation, collapse, or lateral movement;

B. Use **flood** resistant materials below the **FPE**;

C. Use construction methods and practices that do not increase the potential for increases in **flood** damage;

D. Elevate electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities to the **FPE** or higher;

E. Provide adequate access and drainage; and

F. Provide a backup power source that will activate without human intervention if electricity is required.

<u>Accessory Structures</u>

New **accessory structures** within the **floodplain** shall be elevated according to the **NFIP Ordinance** adopted by the **municipality**. At a minimum, **accessory structures** must be elevated to the **BFE**.

Parking Lots

There is no specified maximum **flood** depth on new parking lots in the **floodplain**, however, any parking lot built below the **100-year flood elevation** must clearly post the potential **flood** hazard.

Water and Wastewater Systems

New and replacement water supply systems, wells and sanitary systems in areas adjacent to or within the **floodplain** must have all above ground openings above the **FPE** or be watertight (§602.19). New waste disposal systems on the **site** shall not be constructed within the **floodplain** (§602.22).

Methods for Providing Flood Protection

As discussed above, new **buildings**, new additions to existing **buildings**, or existing **buildings** in the **floodplain** undergoing **substantial improvement** must have all usable space elevated to the **FPE** (which is two feet above the **BFE**). **Floodproofing** is not permitted on new **buildings**, both residential and **non-residential**. Instead, the **building** must be elevated. This can be accomplished a number of ways, as discussed below.

Elevation Using Fill

Fill may be placed on a **site** to elevate a portion of the property above the **FPE** in order to provide a buildable area for a proposed **building** or **structure**. Any fill used to elevate a **building** must extend at least 10 feet beyond the foundation before the grade slopes below the **100-year flood elevation** (§602.13). This 10-foot buffer around the **building** reduces potential damage and impacts resulting from hydrostatic forces on the **building** from the surrounding **base flood** waters.

Any fill required to elevate a **building** or **structure** to the **flood protection elevation** must also adhere to all other provisions of the WMO. Any fill placed within the **floodplain** to meet **flood** protection requirements must also meet **compensatory storage** requirements as outlined in §602.9 and §602.10 of the WMO.

FEMA provides a document with information to help ensure that **buildings** or **structures** built on fill are reasonably safe from **flooding**. This document is entitled *Technical Bulletin 10-01* and is available on **FEMA's** website on-line at:

http://www.FEMA.gov/media-library-data/20130726-1511-20490-3169/tb1001.pdf

Elevating by Means Other Than Fill

Elevating a **building** or **structure** to provide the required **flood** protection by means other than filling when within the **floodplain** may be permitted (§602.14). This may be accomplished using stilts, piles, walls, or other foundations. All other provisions of the WMO apply. Additional guidance related to the provisions in §602.14 is contained in the **FEMA** publication *Elevating Residential **Structures*** (**FEMA** 54). This document is available on **FEMA's** website on-line at:

http://www.FEMA.gov/media-library-data/20130726-1509-20490-6744/FEMA54.pdf

<u>Floodproofing of Existing Structures</u>

Existing **structures**, including **buildings**, in the **floodplain** may be **floodproofed** (§602.12). New **structures**, other than **buildings**, can be **floodproofed** (§602.4). For both cases, the requirements of §602.12 and §602.14 must be followed. **Floodproofing** is defined in the WMO as "additions, changes, or adjustments to **structures** or land that prevent the entry of **flood** water in order to protect property from **flood** damage." **FEMA** provides a number of publications on **floodproofing**, including ***Non-Residential Floodproofing*** *– Requirements and Certification* (FIA-TB-3).

Compensatory storage is not required for any **floodproofing** measures or protection of an existing **structure** or existing **building** provided that the **flood** protection measures are within 10 feet of the outside face of the **structure**. Any fill or material required for **floodproofing** beyond 10 feet of the outside of the **structure** shall require **compensatory storage**. Further information regarding **compensatory storage** can be found below.

<u>Substantial improvements to Existing Structures in the Regulatory Floodplain</u>

The same requirements apply to **substantial improvement**s made to existing **buildings** located in the **regulatory floodplain** and outside the **regulatory floodway**. The footprint of existing **buildings** located in the **regulatory floodway** cannot be increased. According to the **FEMA** definition, **substantial improvement** is any repair, reconstruction, rehabilitation, addition, or other improvement of a **building**, the cost of which improvement equals or exceeds, individually or in the aggregate, 50 percent of the fair market value of the **building**. Communities participating in the **NFIP** may have a more restrictive definition of **substantial improvement** and the local government agency **NFIP** Ordinance should be consulted.

The administrative requirement to determine if an improvement is a **substantial improvement** is the responsibility of the **NFIP** community and may include activities that do not affect **stormwater**, such as internal remodeling or exterior improvements such as siding and windows. The **District** does not regulate **substantial improvements** under the WMO.

<u>Elevating Structures Outside of the Regulatory Floodplain</u>

There are many **flood**-prone **structures** throughout **Cook County** that are not mapped within an **SFHA**. These **structures** do not **flood** as a result of overbank **flooding** from a **waterway**, but rather from **storm events** exceeding the design capacity of the local drainage system. Since these **structures** are not within the **regulatory floodplain**, the **structure** can be elevated by means other than fill and are not bound to the requirements of §602.3 of the WMO. There are two acceptable methods for elevating these types of **structures**, which includes: (1) elevating the top of the **basement** window well to the **FPE** (as shown in Figure 6.5), and (2) the construction of a **flood** control berm that is elevated to the **FPE**. The **FPE** in these cases is the **100-year flood elevation** (if known), or the historical **flood** elevation, plus two feet of freeboard.

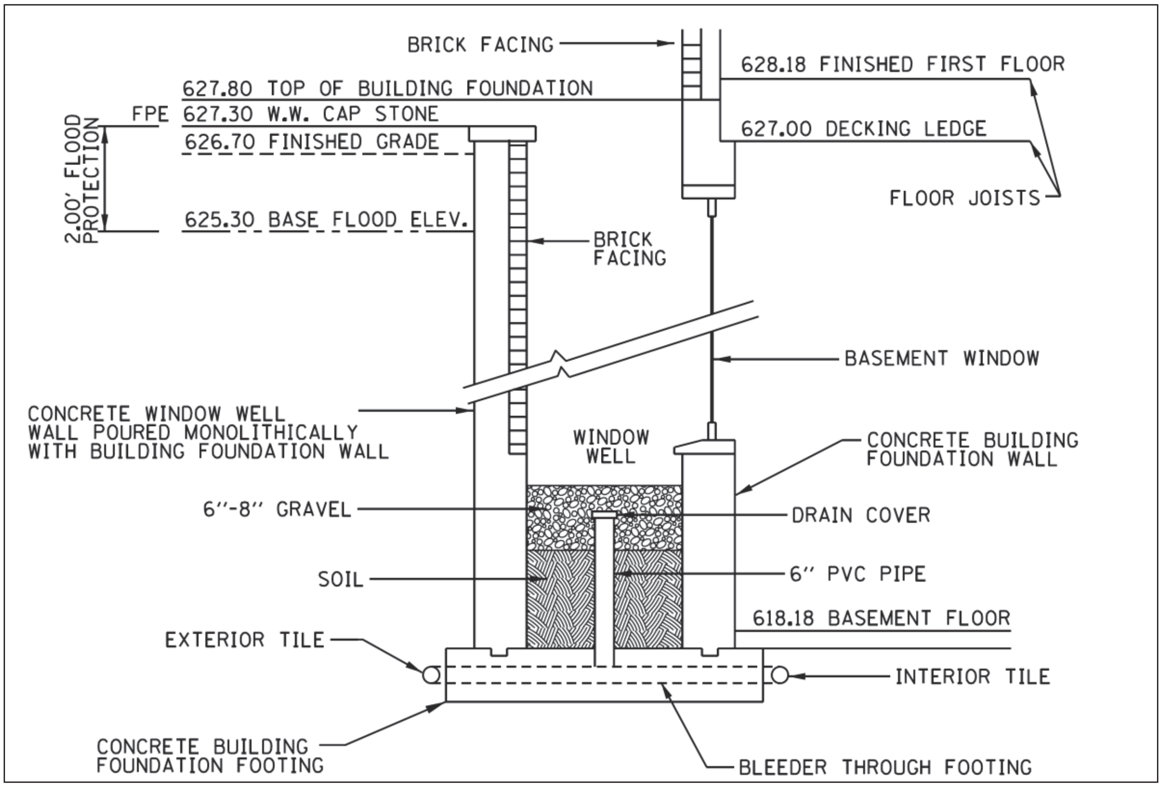


Figure 6.5. Waterproofed Window Well Elevated to the FPE

As shown in Figure 6.5 above, the window well must be poured with the **building** foundation wall and elevated to the **FPE**. In addition, the window well drain must be tied into the **building's** drain tile/sump pump system to avoid a hydraulic connection to the flooding source.

Stormwater Facilities and Detention in the Regulatory Floodplain

Stormwater Facilities and Storm Sewer Outfalls

Stormwater facilities are allowed in the **regulatory floodplain**. Per the WMO §602.18, **stormwater facilities**, such as culverts, bridges, and impoundments that have an associated backwater cannot not be removed, replaced, or modified unless:

1. All **structures**, including **buildings**, within the backwater area of the existing **stormwater facility** are identified and their associated **lowest entry elevations** are determined;

2. **Hydraulically equivalent compensatory storage** is provided to mitigate any potential increases in flow or **flood** elevations upstream or downstream of the **stormwater facility** that is removed, replaced, or modified; and

3. A **water resource benefit** is provided to the area as a result of the removal, replacement, or modification of the **stormwater facility**.

The **structures**, including **buildings**, within the backwater area should be shown on a map or exhibit, and the **lowest entry elevation** should be determined by a field survey. The water resources benefit means that there must be a decrease in **flood** elevations, a reduction in **flood** damages to **structures** upstream or downstream of the **development site**, and/or enhancement of existing water-related environmental resources.

The WMO (§602.25) requires that new or modified **storm sewer outfalls** in the **regulatory floodplain** must meet the general **site** requirements (§501), **site runoff** requirements (§502), and **Illinois Department of Transportation's** (**IDOT**) minimum standards. Relevant **IEPA** and **NPDES** permits are required for all new **outfalls** to **waterways** and Lake Michigan.

<u>Detention Facilities in the Floodplain and Regulatory Floodway</u>
The WMO prohibits construction of **detention facilities** within the **regulatory floodway** (§602.23). This is to ensure that the **floodway** is available for **flood** water conveyance. The WMO §602.24 allows **detention facilities** to be located outside of the **regulatory floodway** but within the **floodplain**, provided that the **site runoff** storage facility:

1. Stores the required **site runoff** under all stream flow and backwater conditions up to the **100-year flood elevation**, assuming a zero release rate below the **100-year flood elevation**; and

2. Does not allow design release rates to be exceeded under any stream elevation less than the **100-year flood elevation**.

Detention facilities must also meet the requirements of §504.11 of the WMO.

During events where the 100-year storm has occurred onsite, but the area downstream of the outlet **structure** (likely the **waterway**) is not at the 100-year **base flood** elevation, the outlet **structure** will have no tailwater. For this condition, it must be verified that the release rate for the **site** has not been exceeded.

Detention within the **floodplain** utilizes the existing **floodplain** area to store **stormwater runoff**. The difficulty with this approach is demonstrating timing. The applicant must demonstrate that the **stormwater runoff** is stored or detained before the floodwaters rise and fill the basin. Detention volumes must be sized for maximum tailwater conditions, while detention release rates are sized for no tailwater. This is discussed in more detail in Article 5.

Compensatory Storage in the Regulatory Floodplain

It is necessary to preserve the natural storage within **floodplains**. Filling without providing **compensatory storage** could lead to increases in **flood** depths and the frequency of **flooding**. **Compensatory storage** is the replacement of storage within the **floodplain** and **floodway** due to filling or the construction of **structures** as part of a project. **Compensatory storage** is required to ensure that new **development** does not result in an increase in **flood** heights on adjacent properties or an increase in **flood** flows.

The WMO requires **compensatory storage** for any fill, **structure**, or other material above the existing ground elevation in the **regulatory floodplain** that temporarily or permanently displaces **floodplain** storage volume (§602.9). **Compensatory storage** must:

- Equal at least 1.1 times the volume of **flood** storage lost below the **BFE**;
- Be operational prior to the placement of fill, **structures**, or other materials temporarily or permanently placed in the **regulatory floodplain**;
- Be provided in the immediate vicinity of the **flood** storage lost, where practicable;
- Be provided in addition to the **site** detention volume; and
- Drain freely and openly to the **waterway**.

The WMO (§602.10) also requires that **compensatory storage** be provided incrementally such that:

- All **regulatory floodplain** storage lost below the existing regulatory 10-year **flood** elevation shall be replaced below the proposed regulatory 10-year **flood** elevation;
- All **regulatory floodplain** storage lost above the existing regulatory 10-year **flood** elevation shall be replaced above the proposed regulatory 10-year **flood** elevation; and
- The additional **compensatory storage** required beyond a one to one (1:1) ratio may be placed above or below the proposed regulatory 10-year **flood** elevation.

Note that the WMO requires **compensatory storage** for activities in the **regulatory floodplain**. There is no minimum for providing **compensatory storage**; any volume of fill requires **compensatory storage** be provided. However, the **compensatory storage** requirement does not apply to specific activities in the **regulatory floodplain**, such as the **floodproofing** of an existing **building**, where the **floodproofing** measures such as berms or floodwalls are within 10 feet of the **building**.

Table 6-2. Compensatory Storage by Development

WMO Section	Development	Compensatory Storage (in Regulatory Floodplain)
§602.2, §602.3, §602.4	New or Existing **Buildings**, and New **Structure**s, Elevated by Fill	Yes
§602.14	New or Existing **Buildings**, and New **Structure**s, Elevated by Method Other Than Fill	No
§602.11	**Floodproofing** of Existing **Buildings** and **Structures**	Not for volume displaced by **building** and 10 feet from **building**

Computing Compensatory Storage

The WMO requires that for any fill placed within the **floodplain**, 1.1 times the volume of **compensatory storage**, i.e., cut, is provided. Fill is measured between the existing ground elevation and the *existing* 10-year and **100-year flood elevations**. **Compensatory storage** needs to be provided between the proposed ground elevation and the *proposed* **floodplain** elevation. In some instances during large **developments** or regrading projects, the **BFEs** are modified due to cuts and fills or relocation of the **waterway**. This is why the **compensatory storage** is then provided between the proposed ground elevations and the proposed **floodplain** elevation. In many projects the existing and proposed **floodplain** elevations will remain unchanged.

Referring to Figure 6.7, equivalent storage lost between the existing ground and the existing 10-year **flood** elevation must provide **compensatory storage** between the proposed ground elevation and the proposed 10-year **floodplain** elevation. Storage lost between the existing 10-year and the existing **100-year flood elevation** must be compensated for between the proposed 10-year and proposed **100-year flood elevations**. The additional **compensatory storage** required beyond the 1:1 ratio may be placed either above or below the 10-year **flood** elevation.

It should be noted that no **compensatory storage** credit will be given for any cut below the normal water level. In addition, some **municipalities** may prescribe **compensatory storage** requirements that differ from the 1.1:1 ratio specified in the WMO. For projects in these communities, the applicant should follow the more restrictive **compensatory storage** requirement.

When preparing a grading plan, thought should be given to how **compensatory storage** will be quantified. The acceptable method of calculating cut and fill volumes is the use of cross-sections and the “average end method.” The following requirements should be followed when preparing cross-sections:

1. Prepare a detailed topographic survey tied to the North American Vertical Datum of 1988 and the **Cook County** Survey Control Network benchmarks.

2. Locate cross-sections parallel to each other and perpendicular to a reference line, oftentimes a property line or fence line. Cross-sections used in a hydraulic model are always perpendicular to **flood** flows, and not always parallel to each other. Therefore, these are often not suitable for computing **flood** fringe **compensatory storage** volumes.

3. Plot cross-sections at a standard engineering scale so as to allow the reviewer to verify areas. The horizontal scale should be a maximum of 1 inch = 50 feet and vertical scale should be a maximum of 1 inch = 5 feet, or as approved by the **District**.

4. Show existing ground elevations, proposed ground elevations, existing and proposed 10-year **flood** elevations, existing and proposed **100-year flood elevations**, normal water level, a reference line, and **floodway** limits on the cross-sections on the plans.

5. Locate cross-sections no more than 150-feet apart, with a minimum of three cross-sections per cut/fill area, or as necessary to accurately quantify cuts and fills.

6. Locate cross-sections to pick up critical features such as berms, ditches, and existing and proposed **structures**.

7. Each cross-section should be numbered or lettered and referenced on the plans.

This information can then be utilized to compute the areas of cut and fill. A sample **compensatory storage** plan is provided as Figure 6.6 and the **compensatory storage** calculations are shown in Table 6-3. For clarity, the topography has not been included on Figure 6.6.

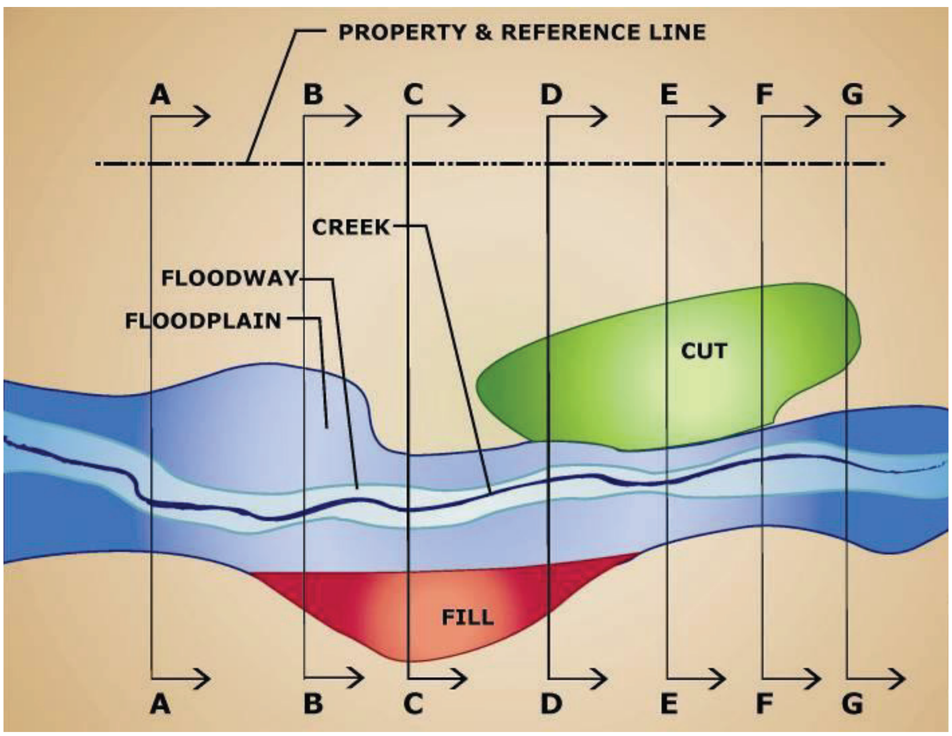


Figure 6.6. Compensatory Storage Calculation Example

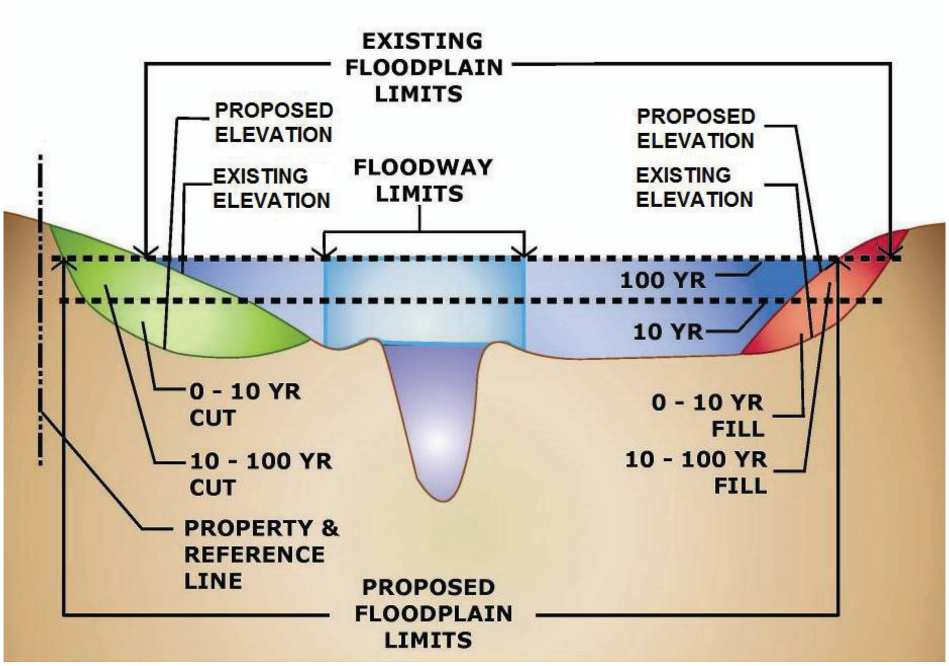


Figure 6.7. Cross-section D-D from the Compensatory Storage Plan provided in Figure 6.6

Table 6-3. Example of Compensatory Storage Calculation, 0 – 10 Year Increment

Cross-Section ID	Distance (ft)	Fill Area (ft^2)	Average Fill Area (ft^2)	Volume of Fill (ft^3)	Cut Area (ft^2)	Average Cut Area (ft^2)	Volume of Cut (ft^3)
A		0			0		
	150		50	7,500		0	0
B		100			0		
	90		125	11,250		0	0
C		150			0		
	100		125	12,500		62.5	6,250
D		100			125		
	100		50	5,000		142.5	14,250
E		0			160		
	100		0	0		175	17,500
F		0			190		
	85		0	0		127.5	10,838
G		0			65		
			Total Fill =	**36,250**		**Total Cut =**	**48,838**
			Compensatory Storage Required = 1.1* Fill =	**39,875**			

Equation Formulas for Table 6-3:

Fill area between Cross-sections A & B:

$$\text{Average Fill Area} = \frac{\text{Fill Area "A"} + \text{Fill Area "B"}}{2}$$

$$\text{Average Fill Area} = \frac{0\,ft^2 + 100\,ft^2}{2} = \boxed{50\,ft^2}$$

Fill volume between Cross-sections A & B:

$$\text{Volume of Fill} = (\text{Average Fill Area}) \times (\text{Distance})$$

$$\text{Volume of Fill} = (50\,ft^2) \times (150\,ft) = \boxed{7{,}500\,ft^3}$$

Compensatory Storage required for fill placed between the 0- and 10-yr **flood** elevation:

$$\text{Required Compensatory Storage} = (1.1) \times (\text{Total Volume of Fill})$$

$$\text{Required Compensatory Storage} = (1.1) \times (36{,}250\,ft^3) = \boxed{39{,}875\,ft^3}$$

Is the Total Volume of Cut Provided greater than or equal to the Total Required Volume of Cut (**Compensatory Storage**)?

$$48{,}838\,ft^3 \geq 39{,}875\,ft^3 \rightarrow OK$$

The total **floodplain** fill is multiplied by 1.1 to determine the cut required. The total **compensatory storage** for this **site** must be at least 36,250 multiplied by 1.1, which is 39,875 cubic feet. Table 6-3 shows that 48,838 cubic feet will be provided, which meets the 1.1:1 **compensatory storage** requirement.

It is not permissible to subtract the fill from the cut for each cross-section. For example on cross-sections C & D, the volume of fill is 12,500 cubic feet and the volume of cut is 6,250 cubic feet. It is not permissible to subtract 6,250 from 12,500 and multiply the result (6,250) by 1.1 (6,250*1.1=6,875). This results in inadequate volume.

Instead, for this cross-section, 12,500 cubic feet is multiplied by 1.1 which results in 13,370 cubic feet of required **compensatory storage**. This computation for each cross-section also equals the 39,875 cubic feet of required total **compensatory storage** for the **site**. Again, the sum of the volume of cut in Table 6-3 shows that 48,838 cubic feet will be provided, which meets the 1.1 **compensatory storage** requirement.

Location of Compensatory Storage

Compensatory storage must be located onsite and adjacent to or opposite the areas filled or occupied by a **structure**. In those rare instances when **compensatory storage** cannot be located adjacent to or opposite to the areas filled or occupied, engineering computations are required that demonstrate **hydraulically equivalent compensatory storage** has been provided. These computations must show that no increase **flood** depths (≤0.10 foot) will result from the location of the proposed **compensatory storage**.

Compensatory storage must be constructed to drain freely and openly to watercourses (§602.9.E). In some rare cases it may be necessary to install pipes to construct and/or operate a **compensatory storage** basin. This may occur when **site** constraints, such as a roadway or sidewalk, separate the **waterway** from the **compensatory storage** area. This is illustrated in the top half of Figure 6.8.

Another scenario may occur when a **site** cannot meet the incremental storage requirements of the WMO. If incremental storage requirements from the 10-year to **100-year flood elevations** cannot be met, pipes could be installed with a flap gate to prevent the water from entering from the stream bed at lower elevations. The berm could then be set at the elevation of the 10-year **BFE**, thus allowing the storage to only become effective above the 10-year **flood** elevation. This is illustrated in the bottom half of Figure 6.8.

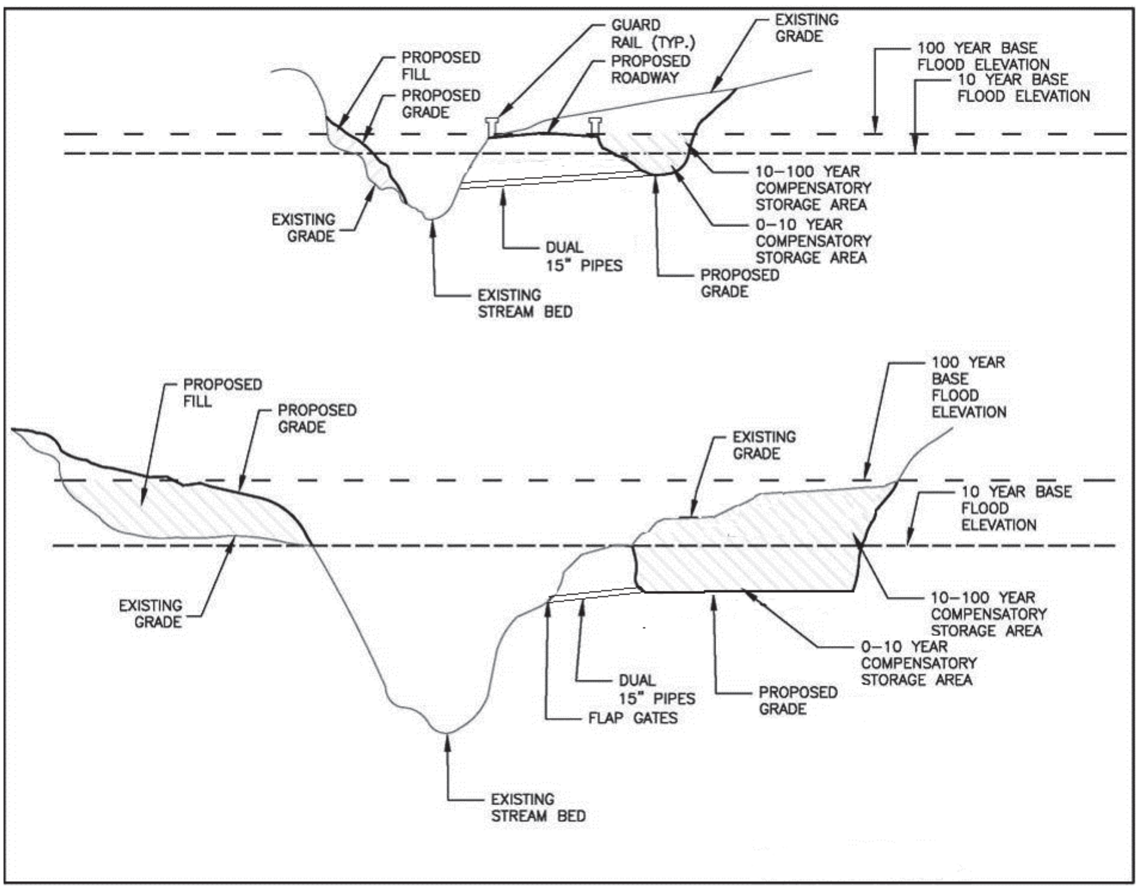


Figure 6.8. Example of a Compensatory Storage Plan

The use of pipes in **compensatory storage** will require approval by the **District** or an **authorized municipality**. If approved, two pipes will be required to reduce the risk of clogging. Pipes must be a minimum of 15 inches in diameter so as to allow water to enter and exit freely with a minimum head differential. If the **compensatory storage** is proposed to be combined with detention, it must be demonstrated that the entire storage volume is accessed during a **storm event** by analyzing the timing of both the **compensatory storage** and detention storage.

Development in the Regulatory Floodway

Appropriate Uses

In Illinois, the **OWR** has been delegated the authority over **regulatory floodways**. **OWR** has jurisdiction of those areas designated on the **FIRM** as the **regulatory floodway**, and also any **waterway** that drains more than one square mile of area. Any **development** in the mapped **regulatory floodway**, or in an area that drains more than one square mile, will require a **Floodway** Construction Permit from the **OWR**. The **OWR** permit application is available on-line at:

http://www.dnr.illinois.gov/WaterResources/Documents/JointpermitApp.pdf

Only **appropriate uses** as defined within the WMO will be permitted within the **regulatory floodway**. The list of **regulatory floodway appropriate uses** can be found in §602.29 of the WMO. These are taken from the **OWR's** *Part 3708 - **Floodway** Construction in Northeastern Illinois.* The **OWR** Part 3708 rules are available on-line at:

http://www.dnr.illinois.gov/adrules/documents/17-3708.pdf

Appropriate uses are those **developments** necessary or that provide a **stormwater** benefit to the **watershed**. These **appropriate uses** are based on the WMO's goals and objectives to improve water quality and mitigate or minimize **stormwater flood** damages. Any proposed **development** in the **regulatory floodway** must also meet the requirements for **development** in a **floodplain** (§602). Only the following **appropriate uses** shall be considered for permits for **development** in a **floodway**:

1. **Flood** control **structure**s, dikes, **dams**, and other public works or private improvements relating to the control of drainage, **flooding**, or **erosion**, or water quality or habitat for fish and wildlife that provides a **water resource benefit**;

2. **Structures** or facilities relating to the use of, or requiring access to, the water or shoreline, such as pumping and treatment facilities, as well as facilities and improvements related to recreational boating, commercial shipping, and other functionally dependent uses;

3. Storm and **sanitary sewer outfalls**;

4. Underground and overhead utilities;

5. Recreational facilities such as playing fields and trail systems including any related fencing built parallel to the direction of **flood** flows;

6. Detached garages, storage sheds, or other non-habitable **accessory structures** to existing **buildings** that will not block **flood** flows. This does not include the construction or placement of any other new **structures**, fill, **building** additions, **buildings** on stilts, fencing (including landscaping or plantings designed to act as a fence), and the storage of materials;

7. Bridges, culverts, roadways, sidewalks, railways, runways, and taxiways, and any modification thereto;

8. Parking lots built at or below existing grade where either:

    a. The depth of **flooding** at the **BFE** will not exceed one foot; or

    b. The parking lot is for short-term outdoor recreational use facilities where the applicant agrees to restrict access during overbank **flooding** events and agrees to accept liability for all damage caused by vehicular access during all overbank **flooding** events. Signs shall be posted to clearly identify the **flooding** hazard.

9. Aircraft parking aprons built at or below ground elevation where the depth of **flooding** at the **BFE** will not exceed one foot;

10. **Regulatory floodway** re-grading without fill to create a positive slope toward the watercourse;

11. **Floodproofing** activities to protect existing **structures** including, but not limited to, constructing water tight window wells and elevating;

12. The replacement, reconstruction, or repair of a damaged **building**, provided that the outside dimensions of the **building** are not increased, and provided that, if the **building** is damaged to 50% or more of the **building's** market value before it was damaged, the **building** will be protected from **flooding** at or above the **FPE**; and

13. Modifications to an existing **building** that would not increase the enclosed floor area of the **building** below the **BFE**, and would not block **flood** flows to – including, but not limited to – fireplaces, bay windows, decks, patios, and second story additions.

Certain types of projects are authorized by the **OWR** through Statewide and General Permits, and therefore do not require permitting through the **OWR**. For these types of projects, a letter from the **OWR** that verifies the proposed project is in compliance with the requirements of the Statewide or General Permit should be submitted to the **District** or the **authorized municipality**. The **OWR** Statewide and General Permits are available on-line through the **OWR's** website at:

http://www.dnr.illinois.gov/waterresources/pages/permitsstatewideregionalgeneral.aspx

Regulatory Floodway Performance Standards

The WMO (§602.27) requires that a **development** must preserve effective the **regulatory floodway conveyance** such that there will be no increases in **flood** elevations, flowrates, or **regulatory floodway** velocity, unless:

1. These increases are contained in a public **flood** easement;

2. A **water resource benefit** is provided; and

3. A **CLOMR** is issued by **FEMA** prior to any work in the **regulatory floodway**. Only **appropriate uses** of the **regulatory floodway** are allowed by the WMO (§602.29). If a portion of the **regulatory floodway** is vital to a **development** and the **development** is not an **appropriate use**, then the **regulatory floodway** must be relocated, but in such a manner that all requirements of §602.27 are met.

The **floodway conveyance**, K, is calculated at each cross-section using the following:

$$K = \frac{1.49}{n} * A * R^{2/3}$$

Where,

n = Manning's roughness coefficient,
A = effective flow area of the cross-section, and
R = hydraulic radius.

For any proposed **development** within the **regulatory floodway**, the applicant must provide the **District** or **authorized municipality** with an evaluation of the hydrologic and hydraulic impacts of the **development** (§304.10) in order to prove compliance with §602.28:

1. Using the **regulatory floodplain** model, if available, or a study as directed by the **District** or **authorized municipality** using the methodology provided in §601.6;

2. For the 2-year, 10-year, and 100-year **storm events** for the 24-hour event, at a minimum; and

3. For existing and any future planned **watershed** conditions as directed by the **District** or **authorized municipality**.

The impacts must meet the standards in §602.27 of the WMO. Minor **development** projects that don't involve fill in the **floodway** and have a hydraulic impact may not require a hydraulic and hydrologic analysis and will be evaluated on a case-by-case basis by the **District** or **authorized municipality**.

Results must show no increase in **flood** flows or **flood** elevations for the full range of **storm events** (50 percent (2-year) through the one percent (100-year) **storm events**). For **OWR** permitting purposes, proposed **developments** must show no more than a 0.04-foot increase in **flood** elevations. This threshold demonstrates “no increase.” **FEMA** coordinates with **OWR** on the issuance of **CLOMR**.

Compensatory Storage in the Regulatory Floodway

Only **developments** that are considered **appropriate uses** of the **regulatory floodway** will be allowed to fill within the limits of the **floodway**. Any fill placed within the existing **floodway** must be compensated for within the proposed **floodway**. All **floodway** storage lost below the existing 10-year **flood** elevation shall be replaced at a 1.1:1 ratio below the proposed 10-year **base flood** elevation. All **floodway** storage lost between the existing 10-year **flood** elevation and the existing **100-year flood elevation** shall be replaced at a 1.1:1 ratio between the proposed 10-year and proposed **100-year flood elevation**.

There shall be no reduction in **floodway** surface area as a result of a **floodway** modification, unless such modification is necessary to reduce **flooding** at an existing **structure**.

Per the **OWR** Part 3708 Rules, cross-sections used in the **compensatory storage** calculations must be located perpendicular to **flood** flows. These cross-sections may be different than those utilized for computing **flood** fringe **compensatory storage**. The average end method should be used when calculating the **floodway compensatory storage**.

Other Development in the Regulatory Floodway

If the proposed **development** does not constitute an **appropriate use** as defined in the **OWR** Part 3708 Rules, the **development** may only take place if the **regulatory floodway** boundary is revised to remove that area from the **regulatory floodway**. The following process is required to revise the **regulatory floodway** boundary:

1. A **CLOMR** must be issued by **FEMA** that acknowledges that the **regulatory floodway** will be revised if the project is constructed. Approval from the **municipality** must be obtained by using **FEMA’s** Community Acknowledgement Form. Concurrence from the **District** or **authorized municipality** and the **OWR** is also required.

2. Construct only that portion of the project that will result in the revision to the **regulatory floodway** boundary.

3. Based on the as-built plans for the project, **FEMA** must issue a **LOMR** for the **site**. Approval from the **municipality**, the **OWR**, and the **District** is also required. The **LOMR** officially revises the **floodway** boundary on the **site**.

4. Since the **floodway** is now removed from that portion of the **site**, **development** in that area is no longer subject to the **appropriate use** regulations.

REQUIREMENTS FOR WETLAND BOUNDARY, QUALITY, AND BUFFER WIDTH DETERMINATION (§603)

Introduction

Wetlands may provide a variety of functions, including natural **stormwater** storage, attenuation of peak **floods**, **groundwater** recharge, water quality enhancement, plant and wildlife habitat, and aesthetic, recreational, educational, and economic benefits.

The "Federal Water Pollution Control Act of 1972," referred to as the Clean Water Act (CWA), established objectives for restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The Secretary of the Army, acting through the **Army Corps of Engineers (Corps)**, is authorized to issue permits for the discharge of dredged or fill material into the **waters of the United States** (US), including **wetlands**, under Section 404 of the CWA. Section 10 of the Rivers and Harbors Act of 1899 authorizes the **Corps** to regulate **structures** and regulate work that is performed in, over, or under navigable waters of the US. Some waters may be regulated under both statutes.

For purposes of the Clean Water Act, "**Waters of the United States**" means:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters, including interstate "**wetlands**";
3. All other waters such as interstate **lakes**, rivers, streams (including intermittent streams), mudflats, sandflats, **wetlands**, sloughs, prairie potholes, wet meadows, playa **lakes**, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
   (a) Which are or could be used by interstate or foreign travelers for recreational or other purposes;
   (b) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   (c) Which are used or could be used for industrial purposes by industries in interstate commerce;
4. All impoundments of waters otherwise defined as **waters of the United States** under this definition;
5. Tributaries of waters identified in paragraphs (1) through (4) of this definition;
6. The territorial sea; and
7. **Wetlands** adjacent to waters (other than waters that are themselves **wetlands**) identified in paragraphs (1) through (6) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA are not **waters of the United States**.

The WMO follows the Clean Water Act of 1972 definition of **wetlands**:

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. ***Wetlands*** *generally include swamps, marshes, bogs, and similar areas.*

Jurisdictional and Isolated Waters and Wetlands

Waters and **wetlands** under the regulatory authority of the **Corps** are referred to as "**Jurisdictional Waters of the US**" and "**Jurisdictional Wetlands**." A **Corps** permit is required for the discharge of dredged or fill material into **jurisdictional waters of the US**, including **wetlands**.

As briefly described above, jurisdictional waters and **wetlands** must meet certain criteria. The USEPA and **Corps** have prepared additional guidance and supporting documentation to further define the intended jurisdictional limits of waters and **wetlands**. However, not all waters and **wetlands** are regulated under the CWA by the **Corps**. Those **wetland** and waters that are not regulated by the **Corps** are referred to as "**isolated waters**" and "**isolated wetlands**". Because of the importance of all **wetlands**, the WMO regulates **isolated wetlands** – **wetlands** that are not protected at a federal level. Waters and **wetlands** regulated by the **Corps** are not regulated by the WMO.

Request for a Jurisdictional Wetland Determination

Wetlands may or may not be regulated by the **Corps**. To make that determination, a *Request for Jurisdictional Determination* must be submitted to the **Corps**. Generally, if a **wetland** has an identifiable surface or subsurface (piped) water connection to other **jurisdictional waters of the US**, the area will likely be regulated.

The determination of jurisdiction can only be made by the **Corps**, therefore, applicants must request a Jurisdictional Determination from the **Corps** (Chicago District) to document which onsite **wetlands** are, or are not, regulated. *Requests for Jurisdictional Determinations* should be made after the **wetland** delineation report has been prepared. A copy of the **wetland** delineation report should be provided to the **Corps** with the request for Jurisdictional Determination.

Wetlands that are not non-**Corps** jurisdictional will be classified as **isolated wetlands**.

Other Reviews or Authorities

Wetlands are regulated by the Illinois Department of Natural Resources (IDNR) when funding from or through the State of Illinois is involved in the **development**. Regulatory authority is established by the Interagency **Wetland** Policy Act (IWPA) of 1989 [20 ILCS 830]. All **wetland** areas are regulated under the IWPA (**Corps** jurisdictional and isolated). Impacts to **wetland** under the IWPA must be mitigated in accordance with the requirements of that Act.

Additionally, any project that must receive state or local approval must complete threatened and endangered species consultation. Regulations and procedures required under the Illinois Endangered Species Protection Act are established in Title 17 Ill. Admin. Code Part 1090. IDNR developed the Ecological Compliance Assessment Tool (EcoCAT) to assist with the review of proposed activities.

General Isolated Wetland Mitigation Requirements

Isolated wetlands have been determined to provide important functions that should be protected and mitigated (replaced) when impacts will occur. Mitigation consists of taking steps to avoid or minimize negative environmental impacts. Mitigation can include: minimizing impacts by limiting the degree or magnitude of the action, rectifying the impact by repairing or restoring the affected environment, reducing the impact by protective steps required with the action, and compensating for the impact by replacing or providing substitute resources.

The WMO requires that **isolated wetlands** impacts be mitigated in cases where the impact exceeds 0.10 acre. Further detail is provided under ***Wetland Avoidance and Minimization Documentation*** in the **TGM**.

Wetland Boundary, Quality, and Buffer Width Determination

Wetland Identification

Development activities that directly or indirectly impact **isolated wetlands** or their associated buffers are regulated by the WMO. Therefore, the applicant(s) (i.e. **co-permittee**) must identify (delineate) any onsite or offsite **isolated wetland(s)** located within 100 feet of the **development site**. The delineation must be completed in accordance with the current **Corps Delineation Manual** and, if applicable, **Natural Resource Conservation Service** (**NRCS**) for **farmed wetlands** determinations. Figure 6.9 illustrates these scenarios.

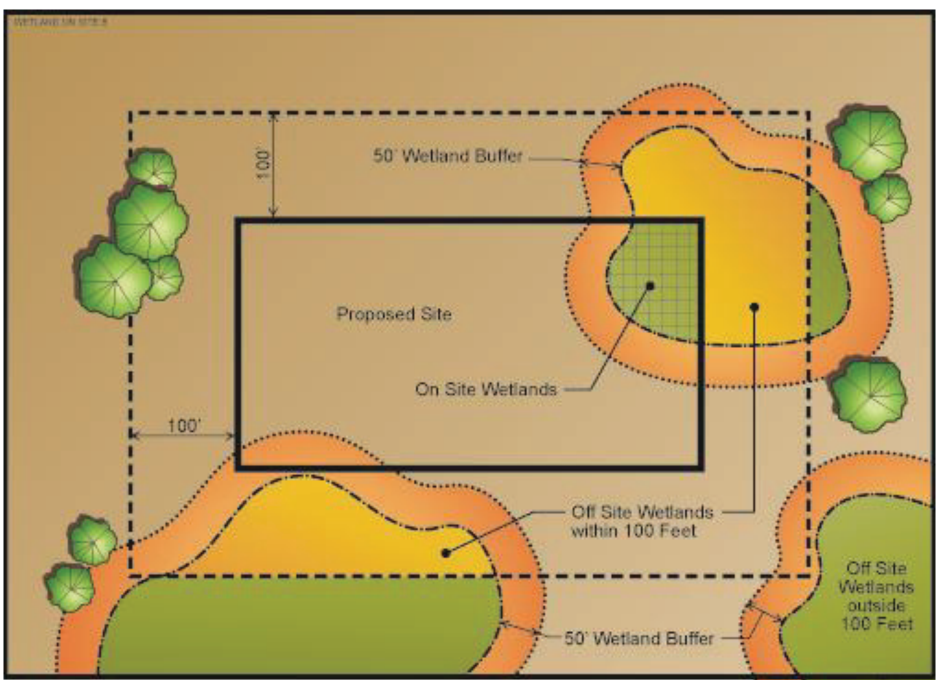


Figure 6.9. Wetland Delineation Scenarios

Onsite Wetland Delineations and Delineation Reports

Onsite **wetland** delineations are to be made using procedures in accordance with the current **Corps Wetland Delineation Manual** (*Regional Supplement to the **Corps** of Engineers **Wetland** Delineation Manual: Midwest Region (Version 2.0)*). The manual is available on-line from the **Corps** website at:

http://www.Corps.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/erdc-el-tr-10-16.pdf

The **Corps** Manual provides data collection requirements, technical guidelines, methods and approaches, and evaluation steps. The WMO places responsibility for identifying the locations of **wetlands** on or offsite on the applicant. **Wetland** delineations should be completed early in the planning process, by trained **wetlands** specialists. The Chicago **District** of the **Corps** maintains an online list of consultants who provide those services.

In accordance with the Delineation Manual, an area qualifies as a **wetland** when the following criteria are met: there is a presence of hydrophytic vegetation, hydric soils, or **wetland hydrology**. If **wetlands** are identified within the **development site**, the **wetland** boundaries must be staked and located via a sub-meter or a more accurate survey and overlaid onto an aerial photo or drawing. **Wetlands** identified offsite, but within 100 feet of the **development site**, shall be delineated using procedures outlined in §603.5. A **wetland** delineation report shall be prepared in accordance with the Delineation Manual and WMO requirements.

The written **wetland** delineation report shall be prepared in compliance with all methodologies and definitions set forth in the WMO and **Corps**. All required documentation to be included in the delineation report may be found in the **wetland** submittal checklist provided in Article 3 of the **TGM**.

Farmed Wetlands Delineations

For **development sites** that are, or have been, used for agricultural production within the past five years, onsite **wetlands** within the agricultural portions of the **site** must be identified and delineated in accordance with the current National Food Security Act Manual (NFSAM) methodology. The NFSAM Manual is available on-line from the US Department of Agriculture, **NRCS** website at:

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/alphabetical/camr/.

It is recommended that **farmed wetland** determinations be completed early in the planning process, by trained **wetlands** specialists. Onsite isolated **farmed wetlands** are subject to the same WMO regulatory requirements as all other non-farmed isolated onsite **wetlands**. Documentation to be included in the delineation report is identified in Article 3.

Onsite Wetland Boundary Verifications
Applicants must contact the **District** or **authorized municipalities** to request a **wetland** boundary verification (§603.7 of the WMO) for all onsite **isolated wetland** determinations and delineations.

Offsite Wetland Delineations
The approximate location, extent and quality of offsite **wetlands** must be identified by the applicant (§603.5 of the WMO). Offsite **wetlands** may be the portion of an onsite **wetland** that extends onto adjoining property, or **wetland** located on an adjacent property within 100 feet of the **development site**. The offsite **wetland** delineation should be completed using the **Corps** Manual whenever possible. If an offsite delineation is not available or cannot be performed, the offsite **wetlands** can be identified by using the following resources:

- National **Wetland** Inventory (**NWI**) Maps from the United States Fish and Wildlife Service (USFWS). The **NWI** map is available at: http://www.fws.gov/nwi/.

- **Natural Resource Conservation Service** (**NRCS**) **wetland** inventory maps. Contact your local **NRCS** field office to obtain a copy of the map for your project location.

- The location and extent of offsite **wetlands** may be identified using other mapping products, including but not limited to: current and historical aerial photographs, US Geological Survey (USGS) hydrological atlas, Soil Survey of **Cook County**, and USGS topographic maps.

Because the **Corps** requires the signature of the property owner, it is difficult to obtain a Jurisdictional Determination for offsite wetlands. For the WMO, offsite wetlands will be considered isolated for the purposes of determining the required buffer width unless it is clear that the offsite wetland would be **Corps** jurisdictional. Examples of these cases where **Corps** jurisdiction is clear include, but are not limited to the following:

- Wetland fringe or wetland adjoining or adjacent to a **Jurisdictional Waters of the US** (drainageway, creek, stream, river) or a pond/lake with an obvious hydrologic traceable connection to a **Jurisdictional Waters of the US** that has been found to be jurisdictional by the **Corps**.

- Wetland with an obvious hydrologic connection to other **jurisdictional wetland** or wetlands in series that have an obvious traceable connection to a Jurisdictional Waters of the US that have been found to be jurisdictional by the **Corps**.

When the applicant and review authority agree the wetland would clearly be **Corps** jurisdictional, the buffers prescribed by the WMO are not required. It should also be noted that offsite **wetlands** that are more than 100 feet away from the proposed **development** (and are not indirectly impacted by the proposed **development**) do not require a **wetland** submittal. However, a statement of opinion must be provided by a **Wetland Specialist** that confirms this.

Exempt Wetlands

The WMO (§603.6) lists **wetland** areas that are exempt from the requirements of the WMO. Exempt **wetlands** are areas that have developed **wetland** characteristics due to either intentional or incidental human activities, e.g., areas that formed by either excavation upland (non-**wetland**) or were created by artificial **hydrology**. These areas are referred to as man-induced **wetlands** that may be exempt from regulation.

For the purposes of the WMO, the following areas are not considered to be **wetlands** and shall be exempt from the **wetland** requirements of the WMO:

1. **Wetlands** in roadside ditches created by excavation in upland areas;
2. **Wetlands** created by excavation or by other unfinished **development** activities in upland areas;
3. **Wetlands** created by artificial **hydrology**, including but not limited to, irrigation or **site runoff** storage facility outlets that would revert to upland areas if irrigation were to cease;
4. **Wetlands** created by the construction of **stormwater facilities** in upland areas, provided that the facility was not created for the purpose of **wetland mitigation**; and
5. **Wetlands** created by the construction of ponds in upland areas.

Wetland Classification

Introduction

Under §603.8 of the WMO **wetlands** must be categorized as “High Quality” or “Standard Quality” based on an assessment of two criteria. If one or both of the criteria are met, the **wetland** is classified as High Quality. If neither criterion is met, the **wetland** is classified as a standard **wetland**. The following are the criteria to be evaluated:

1. **Swink and Wilhelm Floristic Quality Index** (**FQI**) value greater than or equal to 20 during a single season assessment, or a native mean C-value of 3.5 or higher as calculated by the Swink and Wilhelm methodology;

2. The **wetland** is known to possess a federal, or state-listed threatened or endangered species based upon consultation with the Illinois Department of Natural Resources (IDNR) and the US Fish and Wildlife Service (USFWS). This is typically determined through submittal of an Ecological Compliance Assessment Tool (EcoCAT) on-line request to IDNR, and by following the USFWS procedures outlined under Section 7 of the Endangered Species Act of 1973.

Swink and Wilhelm Floristic Quality Index and Native Mean C

Wetland specialists, botanists and plant ecologists use a quantitative measure called the Floristic Quality Index (FQI) to express the "quality" of a natural area. The FQI is an indicator of natural plant biodiversity and conservatism that is widely used throughout Northeastern

Illinois. The use of the FQI as an indicator of **wetland** quality requires identification and cataloging of all plant species in the **wetland** during the growing season. This standardized tool provides a useful number for comparing various natural areas.

To calculate the FQI, each plant species is assigned a predetermined value: a coefficient of conservatism (CC) score that is scaled from 0 to 10. The individual score reflects that species' tolerance to disturbance and specificity to a particular habitat type. Once the plant species inventory has been collected, the FQI can be calculated. The FQI is derived by multiplying the sums of the all C-values by the square root of the number of species identified. The Mean C-value is calculated by summing the Coefficients of Conservatism of the identified species and dividing by the total number of species identified. A computer-based Floristic Quality assessment program is available to compute the Native Mean C, FQI, and other applicable information quickly. Programs that complete the tabulation of plants and complete the calculations are available from Conservation Design Forum and Chicago **District Corps** of Engineers.

References:

Swink, F. and G. Wilhelm (1994). Plants of the Chicago Region, 4th ed., Indiana Academy of Science, Indianapolis, 921 pp.

Wilhelm, G. S. and L. A. Masters (1995). Floristic Quality Assessment in the Chicago Region and Application Computer Programs, Morton Arboretum, Lisle, IL. 17 pp. + Appendices.

Chicago District Corps of Engineers. Beta Version of the Chicago Region Floristic Quality Assessment (FQA) Calculator, January 2014. Excel Format.

<u>Standard Wetlands</u>

Isolated wetlands that do not meet *either* of the above criteria shall be assigned a standard **wetland** status. The **District** or **authorized municipality** will make the final determination of **wetland** status based upon a review of submitted information and, when necessary, upon consultation with outside **wetland** authorities.

Wetland Buffers

<u>Introduction</u>

Wetland buffers help protect **wetland** function by infiltrating **stormwater**, filtering **sediment**, nutrients, and associated pollutants from surface water **runoff**; moderating the temperature of water bodies; and providing organic matter to the **wetland**. Buffers also provide beneficial habitat for wildlife and plant species, and serve as corridors and pathways for movement of species between fragmented habitats. **Wetland buffers** apply to WMO regulated **isolated wetlands**.

Minimum Wetland Buffer Widths

Minimum **wetland buffers** widths for **isolated wetlands** in the WMO are established based upon the **wetland** quality classification (high quality **wetland** versus standard **wetland**). Table 6-4 (Table 3 in the WMO) provides this information.

Table 6-4. Wetland Buffer Determination for Isolated Wetlands

Wetland Quality	Acreage	§603.9(A)	§603.9(B)	§603.8(C)
Standard Isolated Wetland	≥ 0.1 to < 0.5 acre	30 ft.		
	≥ 0.5 acre		50 ft	
High Quality Isolated Wetland	No minimum			100 ft

Minimum **wetland buffer** widths are also depicted in Figure 6.10. **Wetland buffer** widths in the WMO meet the **Corps** minimum standards for **jurisdictional wetland buffers**.

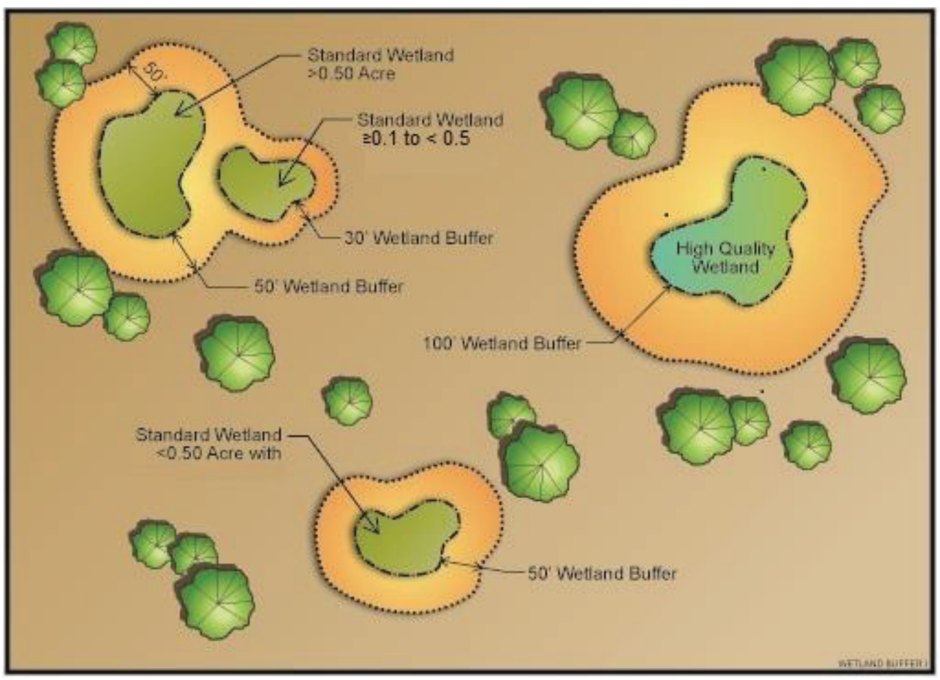


Figure 6.10. Depiction of Minimum Wetland Buffer Widths as Determined by Type of Isolated Wetland

DEVELOPMENT AFFECTING THE FUNCTION AND VALUES OF WETLANDS AND WETLAND BUFFERS (§604)

Introduction

The WMO regulates the direct and indirect impacts to **isolated wetland** and the corresponding buffer. The standards in §604 of the WMO are specific to the completed **wetland** determinations and **wetland** classifications. Table 6-5, taken from the WMO (§604.1) provides a matrix identifying the applicable sections of the WMO for **wetland** and buffer impact requirements:

Table 6-5. Wetland Impact Matrix

Wetland Type	Wetland Area	WMO Section			
		§604.2	§604.3	§604.4	§604.5
Corps Jurisdictional Wetland	Any	X			
Standard Isolated Wetland	< 0.10 acre				x
	≥ 0.10 acre			x	
High Quality Isolated Wetland	Any		X		

Though the WMO does not regulate **Corps jurisdictional wetlands**, the co-applicant must provide a copy or copies of permits issued for impacts to **Corps jurisdictional wetlands** and waters to the **District** or **authorized municipality**. Specifically, **development** that impacts onsite **Corps jurisdictional wetlands** shall be prohibited unless a permit for all regulated activities is obtained from the appropriate federal and state authorities (WMO §604.2).

Wetland Avoidance and Minimization Documentation

<u>Impacts to High Quality Isolated Wetlands</u>

Impacts to **high quality isolated wetlands** are prohibited unless the co-applicant can demonstrate that the presence of **high quality isolated wetlands** precludes all economic use of the **site** and that no practicable alternative to **wetland** modification exist; or the avoidance of **high quality isolated wetlands** would create a hazardous road condition and that no practicable alternative to **isolated wetland** modification exists (§604.3 of the WMO). The process for completing Practicable Alternatives determinations has been defined by the federal government, and these procedures are now used throughout all levels of government to determine whether or not a project is permissible. Below are the definitions of Practicable Alternative and Alternatives Analysis. These definitions are based on guidance prepared by the Federal Government under the Clean Water Act.

> ***Practicable Alternative:*** *A* ***development*** *that is available and capable of being completed after taking into consideration cost, existing technology, and logistics in light of the overall basic* ***development*** *purpose. A study of practicable alternatives should consider possible alternative* ***sites,*** *a reduction in the scale of the* ***development*** *and rearrangement of the proposed facilities. This study assesses actions such as fill* ***site*** *locations, partial and full avoidance of habitats, and restoration and enhancement of habitats and* ***development*** *economics. See also* ***alternatives analysis.***

Alternatives Analysis: *The process of comparing and evaluating two or more courses of action of the various technical aspects of a* ***development*** *with the intent of selecting the action that best meets the stated Basic* ***Development*** *Purpose, while minimizing environmental effects and costs. A practicable alternatives study should consider possible alternative* ***sites****, a reduction in the scale of the* ***development*** *and rearrangement of the proposed facilities. This study assesses actions such as fill* ***site*** *locations, partial and full avoidance of habitats, and restoration and enhancement of habitats and* ***development*** *economics.*

Federal Guidance

The USEPA prepared a document, Memorandum: Appropriate Level of Analysis Required for Evaluating Compliance with the Section 404(b)(1) Guidelines Alternatives Requirements.

"The purpose of this memorandum was to clarify the appropriate level of analysis required for evaluating compliance with the Clean Water Act Section 404(b)(1) Guidelines' (Guidelines) requirements for consideration of alternatives. 40 CFR 230.10(a). Specifically, this memorandum describes the flexibility afforded by the Guidelines to make regulatory decisions based on the relative severity of the environmental impact of proposed discharges of dredged or fill material into ***waters of the United States****."*

"The fundamental precept of the Guidelines is that discharges of dredged or fill material into ***waters of the United States****, including* ***wetlands****, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, will not result in unacceptable adverse effects on the aquatic ecosystem. The Guidelines specifically require that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." 40 CFR 230.10(a). Based on this provision, the applicant is required to evaluate opportunities for use of non-aquatic areas that would result in less adverse impact on the aquatic ecosystem. A permit cannot be issued, therefore, in circumstances where a less environmentally damaging practicable alternative for the proposed discharge exists (except as provided for under Section 404(b)(2))."*

The Federal Guidance speaks of the discharge of material into waters of the US or **wetland**, because in reality dredging on its own is not a Federal regulated activity. But in regards to **Cook County** that activity is regulated, and the evaluation is completed following the spirit of the Federal process.

The Guidelines, as well as the WMO, do not require the same intensity of analysis for all types of projects, but instead envisions a correlation between the scope of the evaluation and the potential extent of adverse impacts on the aquatic environment.

Minor impacts are associated with activities that generally would have little potential to degrade the aquatic environment and include one, and frequently more, of the following characteristics: are located in aquatic resources of limited natural function, are small in size and cause little direct impact, have little potential for secondary or cumulative impacts, or cause only temporary impacts.

It is important to recognize, however, that in some circumstances even small or temporary fills could result in substantial impacts, and that requires a more detailed evaluation.

It is important to note that it is not acceptable for a reviewer to consider compensatory mitigation in making a determination as to whether or not a proposed discharge will cause only minor impacts for purposes of the practicable analysis required.

In reviewing projects that have the potential for only minor impacts on the aquatic environment, Co-applicants and reviewers should consider the following factors:

i. Such projects by their nature should not cause or contribute to significant degradation individually or cumulatively. Therefore, it generally should not be necessary to conduct or require detailed analyses to determine compliance.

ii. Although sufficient information must be developed to determine whether the proposed activity is in fact the least damaging practicable alternative, the Guidelines <u>do not require an elaborate search</u> for practicable alternatives if it is reasonably anticipated that there are only minor differences between the environmental impacts of the proposed activity and potentially practicable alternatives.

    This decision will be made after determining whether potential alternatives would result in no identifiable or discernible difference in impact on the aquatic ecosystem. Those alternatives that do not have a discernible difference may be eliminated from further analysis. Because evaluating practicability is generally the more difficult aspect of the alternatives analysis, this approach should save time and effort for both the applicant and the **District** or **authorized municipality**. By initially focusing the alternatives analysis on the question of impacts on the aquatic ecosystem, it may be possible to limit (or in some instances eliminate altogether) the number of alternatives that have to be evaluated for practicability.

iii. When it is determined that there is no identifiable or discernible difference in adverse impact on the environment between the applicant's proposed alternative and all other practicable alternatives, then the applicant's alternative is considered as satisfying the requirements.

iv. Even where a practicable alternative exists that would have less adverse impact on the aquatic ecosystem, the Guidelines allow it to be rejected if it would have other significant adverse environmental consequences. This allows for consideration of :evidence of damages to other ecosystems in deciding whether there is a 'better' alternative." Hence, in applying the alternatives analysis required by the Guidelines, it is not appropriate to select an alternative where minor impacts on the aquatic environment are avoided at the cost of substantial impacts to other natural environmental features (e.g., removal of quality woodlands to further minimize **wetland impact**).

v. In cases of negligible or trivial impacts (e.g., small discharges to construct individual driveways), it may be possible to conclude that no alternative location could result in less adverse impact on the aquatic environment. In such cases, it may not be necessary to conduct an offsite alternatives analysis but instead require only any practicable onsite minimization.

A reasonable, common sense approach in applying the requirements with sound environmental protection: The WMO contemplates that reasonable discretion should be applied based on the nature of the aquatic resource and potential impacts of a proposed activity in determining compliance with the Practicable Alternatives test.

Hazardous conditions: **Development** that impacts onsite high-quality **wetlands** shall be prohibited unless documentation is submitted that demonstrates that avoidance of high-quality **wetlands** itself would create a hazardous road condition, and that no practicable, safe alternative to **wetland** modification exists. Safety issues often arise associated with certain types of projects, especially roadway **developments**. It is important that unsafe alternatives do not fulfill the basic project purpose. However, an option that meets accepted standards even if it is not the safest option is still practicable.

Based upon a review of the above documentation and any other available resources, the **District** or **authorized municipality** will make the final determination as to whether the proposed high-quality **wetland** modification represents the least amount of **wetland impact** required to allow use of the **parcel** or to mitigate the road hazard. The **District** or **authorized municipality** will then make a determination as to whether the request is permissible.

Impacts to Standard Isolated Wetlands greater than 0.10 acre

§604.4 of the WMO requires documentation as to why **standard isolated wetlands** that are equal to or greater than 0.10 acre in aggregate cannot be avoided and why impacts to **wetlands** must occur. The primary goal is that identified **isolated wetlands** should be avoided; if the **isolated wetland impact** cannot be avoided, then the impact to the **isolated wetland** must be minimized. The co-applicant must demonstrate that the proposed impact is essential for the **development**, that no alternative practical design could be submitted that would result in less impact to the resource. For further guidance regarding this analysis, refer to the practicable alternatives discussed previously in the **TGM**.

Impacts to Standard Isolated Wetlands less than 0.10 acre

For each **standard isolated wetland impact** with a surface area (including adjoining **isolated waters**) of less than 0.10 acre, no documentation of a practicable alternatives is required to support the proposed impact (§604.5). The impacts are automatically acceptable and no practicable alternatives evaluation must be completed. **Wetland mitigation** is required only if the total combined area(s) of **isolated wetland impact** exceeds 0.10 acre.

The cumulative total acreage refers to the acreage of the **wetland(s)** and **contiguous isolated waters**, that when their acreages are combined is less than 0.10 acre. Figure 6.11 demonstrates this concept.

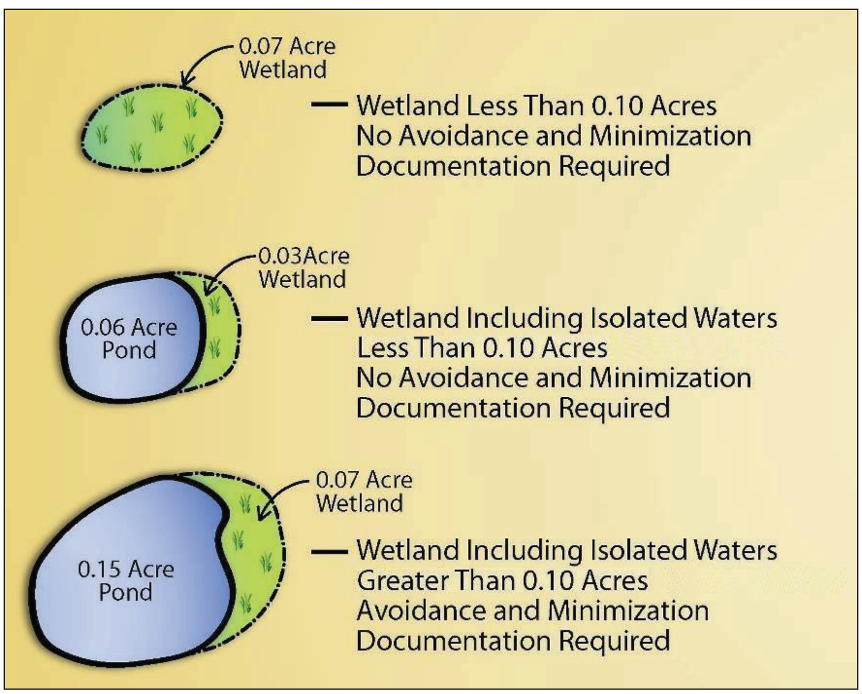


Figure 6.11. Examples of When Documentation is Required Depending on Wetland Acreage

Indirect Wetland Impacts

Activities that occur outside of the identified **wetland** boundaries that alter **wetland** hydrologically are considered to be Indirect **wetland impacts**. Specifically, an **indirect wetland impact** is assumed if the **development** activity causes the **wetland hydrology** to fall below 80%, or to exceed 150%, of the existing condition **storm event runoff** volume to the **wetland** for the

2-year, 24-hour **storm event**. Indirect environmental impacts to **isolated wetlands** must be sufficiently evaluated, minimized, and mitigated (§604.6 of the WMO).

Changes in **hydrology** includes evaluation of increases or decreases in flow, volume, or duration to all identified onsite and offsite **wetlands**. Existing **hydrology** must be maintained as close to 100% as possible during and following construction. An indirect **wetland hydrology** impact shall be assumed to occur if the **development** activity causes the **wetland hydrology** to fall below 80% or to exceed 150% of the existing condition **storm event runoff** volume to the **wetland** for the 2-year, 24-hour **storm event**.

Professional judgment should be taken when evaluating indirect hydrologic impacts. **Wetlands** are highly variable, and calculations in the spreadsheet may not always represent the actual indirect impact to all types of **wetlands**.

Written permission from adjacent property **owners** is required when increased or decreased **hydrology** outside of the 80% to 150% limits is proposed to **wetlands** that are also located on their property.

Detention in Wetlands

The WMO allows **site runoff** storage in **standard isolated wetlands** only (§604.7 of the WMO). This storage allowance does not include temporary detention nor **sediment basins** for **erosion** and **sediment** control. The **hydrology** of the **standard isolated wetland** must be maintained as close as possible to 100%. Proposed detention in a **standard isolated wetland** will only be permitted if it can be demonstrated that the **wetland hydrology** will not fall below 80%, nor will it exceed 150% of the existing condition **storm event runoff** volume to the **wetland** for the 2-year, 24-hour **storm event**.

Detention in any **high quality isolated wetlands** or **Corps jurisdictional wetlands** is not allowed if prohibited by the **Corps** as part of a permit process.

Stormwater Outlets Discharging to Wetlands

Stormwater outlets discharging into a **wetland** will only be allowed provided that appropriate water quality and **erosion control practices** are installed, and that the outlets are proposed to have appropriately designed energy dissipation, such as a level spreader, vegetated swale, or scour protection (§604.8 of the WMO). Project designers are recommended to prepare designs in accordance with the **Illinois Urban Manual** and **IEPA–NPDES** requirements. Please refer to Article 4 for additional requirements regarding design and implementation.

Stormwater outlets discharging into a **wetland** must not result in adverse direct (§604.3, §604.4 or §604.5 of the WMO) or indirect **wetland impacts** (§604.6 of the WMO).

Wetland Mitigation for Impacts to Isolated Wetlands

Introduction

Wetland mitigation for impacts to **standard isolated wetlands** and **high quality isolated wetlands** is only considered an option after the **District** or **authorized municipality** has determined that the applicant has avoided and minimized impacts to **isolated wetlands** to the extent practicable. For **high quality isolated wetlands**, the applicant must satisfy the requirements contained in §604.3 of the WMO. Mitigation is required for **isolated wetland impacts** to replace lost **wetland** function. **Isolated wetland mitigation** shall be completed in accordance with the following criteria:

1. When the cumulative total **standard isolated wetland(s)** impact is less than 0.10 acre, no mitigation is required;

2. When the cumulative total **Standard isolated wetland(s)** impacts are equal to or greater than 0.10 acre, mitigatation shall be provided at a ratio of one-and-one-half acre of creation for each acre impacted (1.5:1);

3. High-quality **isolated wetlands** shall be mitigated at a ratio of three acres of creation for each acre impacted (3:1); and

4. **Isolated wetland impacts** initiated after the effective date of the WMO and prior to issuance of a **Watershed Management Permit**, or other unauthorized impact shall be mitigated at a ratio of three acres of creation for each acre impacted (3:1).

Wetland Mitigation Ratios

Mitigation for **development**s that impact an **isolated wetland** shall provide for the replacement of the lost **wetland** environment according to Table 6-6:

Table 6-6. Isolated Wetland Mitigation Requirement Ratios

Wetland Quality	Area of Impact	§604.9 (A)	§604.9 (B)	§604.9 (C)	§604.9 (D)
Standard Isolated Wetland	< 0.10 acre	None			
	≥ 0.10 acre		1.5:1		
High-Quality Isolated Wetland	Any			3:1	
Impacts Prior to Issuance of Permit					3:1

Acceptable Isolated Wetland Mitigation Credit Options

The co-applicant can provide the required **isolated wetland mitigation** as follows (§604.10 of the WMO):

1. Payment into a **Corps** approved **wetland mitigation** bank within the same **Watershed**

Planning Area as the impact;
2. Payment into a **Corps** approved **wetland mitigation** bank that is closest to the **development** within the same **Corps** Watershed Service Area as the impact as shown in Appendix D of the WMO;
3. Enhancement of an existing onsite **isolated wetland** from a **standard isolated wetland** to a **high quality isolated wetland**, subject to §604.14 of the WMO;
4. Expansion of an existing onsite **isolated wetland**;
5. Onsite **wetland mitigation**; and
6. Offsite **wetland mitigation** within the same **Watershed Planning Area** as the impact.

<u>Wetland Creation Onsite or OffSite</u>
Creation of **wetlands** for mitigation of **development** impacts, within or affecting a **wetland**, may take place only within areas that are not currently **wetlands** (§604.13 of the WMO). The design, analysis, and construction of all **wetland mitigation** shall comply with all applicable federal, state, and local regulations. The Joint **Corps** and Environmental Protection Agency regulation, "Compensatory Mitigation for the Losses of Aquatic Resources (June 2008)," shall be used for mitigating impacts. **Wetland** creation can take place on the **development site** or at another approved location.

<u>Existing Wetland Enhancement</u>
The **District** or **authorized municipality** may allow the enhancement of an existing **wetland** that is within or adjacent to a proposed on- or offsite **wetland mitigation** area in exchange for a partial reduction in the mitigation acreage required (§604.14 of the WMO). Either the **District** or an **authorized municipality** may reduce the total **wetland mitigation** area required by 0.75 acre for every one acre of **wetland** enhancement; however, the area of creation of new **wetlands** to compensate for unavoidable **wetland** loss shall not be allowed to fall below a ratio of one acre of creation for each acre impacted (1:1). **Corps** approval of the proposed enhancement to **Corps jurisdictional wetlands** is required if the co-applicant proposes to obtain enhancement credit in lieu of **wetland mitigation** credit.

<u>Wetland Mitigation Plan</u>

If **isolated wetlands** are proposed to be impacted and mitigated on the **development site**, a **wetland mitigation** plan must be prepared and submitted by the co-applicant (§604.15 of the WMO). The mitigation plan shall include design, construction, monitoring, and **maintenance** of the mitigation measures.

The **wetland mitigation** plans must include sheets that depict the location and extent of the proposed **wetland mitigation** area, impacted **wetlands**, planting zones, planting and grading specifications, soil **erosion** and **sediment** control, and temporary and permanent access locations. A summary table shall be included that tabulates the **isolated wetland** acreages to be disturbed (by classification), mitigation ratios, area by classification to be mitigated, and the total mitigation area acreage. If applicable, the mitigation plan should include the proposed buffer and **riparian environment** mitigation plans and associated supporting documentation.

A narrative description of the proposed plan must be provided that describes the proposed **wetland hydrology**, soil characteristics, the proposed plant communities, and any other local geomorphologic conditions that impact the construction or long term sustainability of the **wetland**.

The mitigation plan shall include specifications for construction. These include but are not limited to: specifications for rough and final grading, soil types, soil handling methods, water control **structures**, plant materials, scientific and common names, rates of seeding or spacing, source, storage, and installation methods.

The **maintenance** plan shall at a minimum include a description of each **maintenance** task proposed and its expected effect, the means of measuring its success, and an annual work schedule including the time of year each task will be performed. A checklist for the mitigation plan sheets and **maintenance** plan is provided in Article 3.

If **wetland mitigation** is required, a **wetland mitigation** document must be prepared by the applicant that includes all required information for the **wetland mitigation** and **maintenance** and monitoring submittals. The **wetland mitigation** document must include the following:

1. Proposed **wetland hydrology** and an inundation and duration analysis;
2. Proposed soils and soil management activities;
3. Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details;
4. Proposed **maintenance** and monitoring plan with **maintenance activities** and performance criteria outlined;
5. Schedule of earthwork, planting, monitoring, and **maintenance**;
6. A plan for the continued management, operation, and **maintenance** of the **wetland mitigation** measures including the designation of funding sources and the **person** responsible for long-term operation and **maintenance**; and
7. A description of applicable temporary and permanent access and **maintenance** and conservation easements granted or dedicated to and accepted by a governmental entity.

Wetland Mitigation Plan Approval

Isolated wetland Impacts may not occur until after the mitigation plan has been approved by the **District** or **authorized municipality** (§604.16 of the WMO).

Annual Wetland Monitoring Reports

The WMO requires that the applicant provide the **District** or **authorized municipality** with annual monitoring reports documenting the status of the constructed mitigation measures for five years, or until such time that the performance criteria has been met (§604.18 of the WMO). The **District** or **authorized municipality** may also require the applicant to undertake remedial action to bring the area into compliance with the mitigation plan. Changes to the mitigation,

maintenance, and monitoring plan shall be approved by the **District** or **authorized municipality** as necessary.

The monitoring plan shall establish performance standards for the **wetland mitigation**. Performance standards are predetermined goals for guiding and measuring mitigation success. The monitoring plan shall identify:

1. The party(s) responsible for monitoring;
2. The data to be collected and reported;
3. The frequency and duration of monitoring;
4. The assessment tools and/or methods to be used for data collection; and
5. The format for reporting monitoring data and assessing mitigation success based upon the proposed performance standards.

Monitoring Reports should contain at a minimum the following information:

- Copies of the mitigation plans and if available, as-built plans;
- Maps, and photographs to illustrate **site** conditions;
- Results of functional, condition, or other assessments used to provide quantitative or qualitative measures of the functions provided by the compensatory mitigation project.

Isolated Wetland Buffer Mitigation

Development within an **isolated wetland buffer** shall not, without mitigation (§604.19 of the WMO):

1. Adversely change the quantity, quality, or temporal and areal distribution of flows entering any adjacent **wetlands** or waters;
2. Adversely affect any **groundwater** infiltration functions; or
3. Destroy or damage vegetation that stabilizes **wetland** fringe areas or provides overland flow filtration to **wetlands**. The removal of invasive vegetation is not considered to be destruction or damage of vegetation.

Impacts to **isolated wetland buffer** areas shall be mitigated through the replacement or enhancement of impacted function (§604.20 of the WMO). Therefore, information must be provided that documents the function(s) of the existing buffer. Function(s) of the impacted buffer may be mitigated by enhancing the plants and **structure** of the remaining buffer.

The WMO does not state that buffer is to be mitigated on area basis, but replacement on an acre-for-acre basis is acceptable. This form of mitigation is referred to as buffer averaging. Buffer averaging is a reduction of the width of a buffer in one area while increasing the width in another without reducing the total surface area of the buffer, maintaining the net surface area of buffer (§603.10 of the WMO). Buffer averaging is allowable if the applicant demonstrates that the averaging will not adversely affect **wetland** function and value, and that the buffer is not reduced in any location by more than 50% or to less than 30 feet total. See Figure 6.12 below for an illustration of this concept.

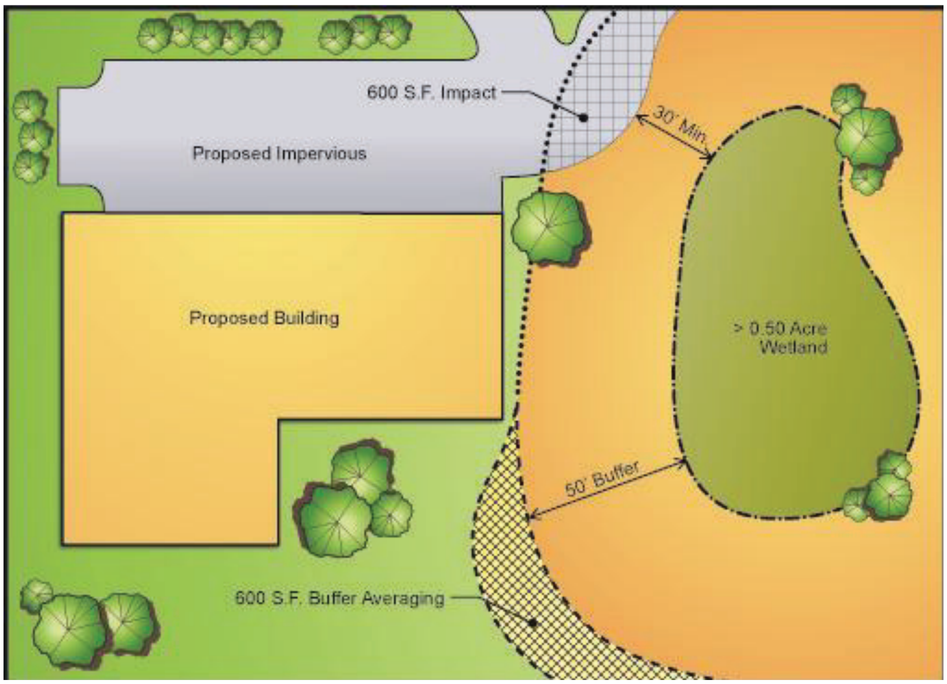


Figure 6.12. Wetland Buffer Averaging

WETLAND BANKING (§605)

When mitigation is provided via **wetland** banking, the Interagency Coordination Agreement (ICA) on Mitigation Banking within the Regulatory Boundaries of Chicago, the **District**, and the **Corps** will be used. The ICA is the guiding document that outlines regulatory requirements for the authorization, management, and monitoring of any proposed **wetland** banks in **Cook County** and surrounding collar counties. The ICA can be viewed on the **Corps** Chicago **District** website.

Isolated wetland mitigation provided through **wetland mitigation** banking shall abide by the following hierarchy (§605.1 of the WMO):

1. Payment into a **Corps** approved **wetland mitigation** bank in the same **watershed planning area**; or

2. Payment into a **Corps** approved **wetland mitigation** bank that is closest to the

development within the same **Corps** Watershed Service Area as the impacts, as shown in Appendix D of the WMO.

Information on **Corps** approved mitigation bank credits within the Chicago **District** Regulatory Branch is available on the *Regional Internet Bank Information Tracking System* (RIBITS). RIBITS was developed for use by **Corps** nationwide to aid in tracking mitigation bank credit and other information. An applicant can determine if mitigation credit is available from any bank noted as "approved." Information regarding RIBITS can be found at RIBITS:

www.lrc.Corps.army.mil/co-r/ribits.htm.

The payment amount made into the **wetland mitigation** banking program will be determined by multiplying the acres of required mitigation by the banking cost quoted by the mitigation banker on a per acre credit basis (§605.2 of the WMO).

Wetland mitigation banking credits for **jurisdictional wetlands** shall be approved by the **Corps** (§605.3 of the WMO). Credits purchased for **jurisdictional wetland impacts** cannot be applied simultaneously to mitigate for **isolated wetland impacts**.

The **Corps** will have the sole authority for approving **wetland mitigation** banks (§605.4 of the WMO). The **District** or an **authorized municipality** will accept credits purchased from **Corps** approved banks for impacts to **isolated wetlands** regulated by the WMO.

RIPARIAN ENVIRONMENTS REQUIREMENTS (§606)

Introduction

Similar to **wetland buffer** areas, **riparian environments** may help to: reduce **flood** flowrates and volumes, provide bank **stabilization**, pollutant assimilation, **sediment** filtration, stream shading, and wildlife habitat functions.

The **Corps** has the authority under Section 404 and Section 10 of the CWA to regulate **riparian environments** that are located within the limits of delineated **Jurisdictional Waters of the US** or **wetlands** when a **Corps** permit is required.

Unlike **wetlands**, the **Corps** and other federal agencies have not defined **riparian environments**. Research by a number of organizations has led to numerous definitions of a **riparian environment**. The WMO defines a **riparian environment** as follows:

> *The vegetated area between aquatic and upland ecosystems adjacent to a **waterway** or body of water that provides **flood** management, habitat, water quality enhancement, or other amenities dependent on the proximity to water.*

The WMO also states that "adverse impacts to the existing functions of a **riparian environment** shall be mitigated and a mitigation plan shall be prepared" (§607.4).

Waters that are exempt from regulation are likewise exempt from having riparian habitat (§606.3 of the WMO) as listed below.

1. Roadside ditches created by excavation for the purposes of **stormwater c**onveyance;
2. Channels or bodies of water created by unfinished **development** activities; or
3. Channels or bodies of water created by the construction of **stormwater facilities** in upland areas for the purposes of **stormwater** management.

It is important to clarify that **stormwater facilities** constructed in hydric soils (non-upland areas) may be considered waters and may therefore provide a riparian habitat.

Development that Impacts Jurisdictional Waters of the US

Waters of the US and **wetlands** are regulated by the **Corps** under Section 404 of the Clean Water Act and other local municipal ordinances; **wetlands** are regulated by the State of Illinois under the Illinois Interagency **Wetlands** Policy Act (IWPA). WMO regulated **riparian environments** located within areas regulated by other agencies cannot commence until permits from the applicable agencies have been obtained and copies provided to the **District** or **authorized municipality**.

Protection of Existing Functions of a Riparian Environment

The WMO requires the protection of the existing functions of a **riparian environment**. Protection of the **riparian environment** functions pertains to the functions of the onsite **riparian environment**. Similar to the **wetland** requirements, the phrasing of "to the extent practicable" is understood as a solution that is feasible to implement after taking into consideration cost, existing technology, and logistics in light of the overall purpose of the **development** (see the avoidance and minimization sequencing discussion in the **TGM**).

Requirements for Development That Affect the Function and Values of Riparian Environments

There are three main standards for **development** that impact **riparian environment** functions:

1. **Development** that impacts **Jurisdictional Waters of the US** on the **development site** shall be prohibited unless a permit for all regulated activities is obtained from the appropriate federal and state authorities (§607.1 of the WMO);
2. To the extent practicable, the existing functions of a **riparian environment** shall be protected (§607.2 of the WMO); and
3. Adverse impacts to the existing functions of a **riparian environment** shall be mitigated and a mitigation plan shall be prepared (§607.4 of the WMO).

The **District**, or **authorized municipality** will make the final determination as to whether the proposed **riparian environment** modifications will be permitted pursuant to a review of a riparian area mitigation plan.

Below is the technical guidance related to the **riparian environment** standards in **Cook County**:

1. **Riparian environment** determination;
2. **Riparian environment** functions;
3. **Riparian environment** exemptions;
4. **Riparian environment** mitigation; and
5. **Riparian environment maintenance** and monitoring.

Riparian Environment Determination

Riparian Identification

Any **development** containing **riparian environment**s requires the identification of the boundaries or limits of those **riparian environment**s and the determination of the **riparian environment** function. The limits of **riparian environment**s are measured from a stream or **waterway's Ordinary High Water Mark (OHWM)** to 30, 50, or 100 feet inland, depending on the stream or **waterway** classification. Within these boundaries, the functional value of the existing vegetation must be assessed.

Because it is the *function* of the **riparian environment** that should be protected, it is important to distinguish those areas that provide a meaningful function from those areas that do not. From a practical standpoint, the following areas are considered to have low functional benefit and should generally not be considered to be "riparian" as they do not meet the definition of **riparian environments** found in the WMO or found within most resource manuals because (1) they are not effective at providing habitat or water quality enhancement and (2) they are man-made ecotypes:

- Paved or graveled surfaces;
- Buildings/structures; and
- Manicured/maintained lawns or formal landscape beds.

Figure 6.13. Examples of Riparian and Non-riparian Environments

Boundaries of Riparian Environments

*Determining **Biological Stream Characterization** and Waters Classification*

Riparian environments adjacent to streams and **waterways** are considered based on the classification of the **waterway** including:

- **Biological Stream Characterization** (**BSC**) of "A" or "B";
- **Biologically Significant Stream** (**BSS**); and
- **Jurisdictional Water of the US**.

The **waterways** classification can be determined by referring to latest edition of the **Illinois Environmental Protection Agency's** *Biological Stream Ratings for Diversity, Integrity and Significance* found at the following website:

http://www.dnr.illinois.gov/conservation/BiologicalStreamratings/Pages/default.aspx .

Determining Limits of Riparian Environment

Table 6-7, taken from the WMO, summarizes the **riparian environment** determinations.

Table 6-7. Riparian Environment Determination

Biological Stream Characterization	Waters Classification	WMO Section		
		§606.2 (A)	**§606.2 (B)**	**§606.2 (C) or (D)**
All other streams	**Jurisdictional Water of the US**	50 feet from the **OHWM**		
	Isolated Waters		30 feet from the **OHWM**	
BSC of "A" or "B" or **BSS** streams	**Jurisdictional Water of the US**			100 feet from the **OHWM**
	Isolated Waters			100 feet from the **OHWM**

Figure 6.14 shows the 50-foot **riparian environment** for a **Jurisdictional Waters of the US** that does not qualify as **wetlands**.

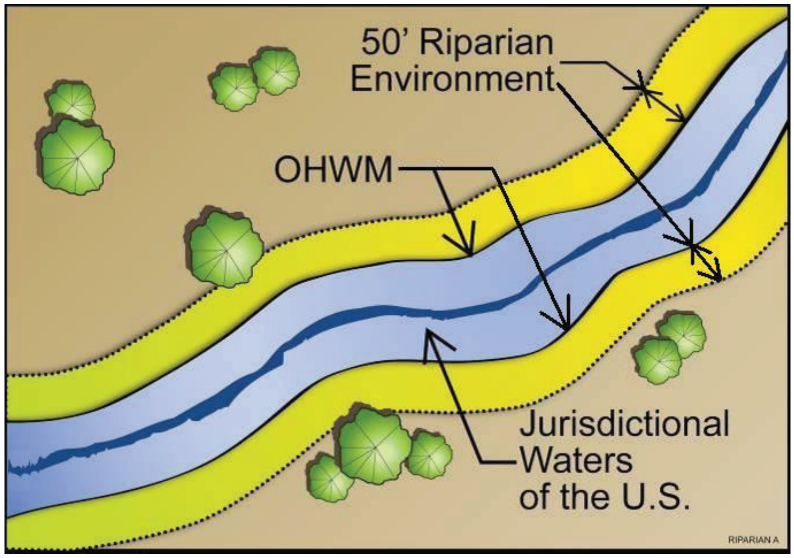


Figure 6.14. Riparian Environment for a Jurisdictional Waters of the US that does not Qualify as Wetlands

Figure 6.15 shows the 30-foot **riparian environment** for an **isolated waters** that does not qualify as **wetlands**. The **riparian environment** shall be 30 feet from the **OHWM**.

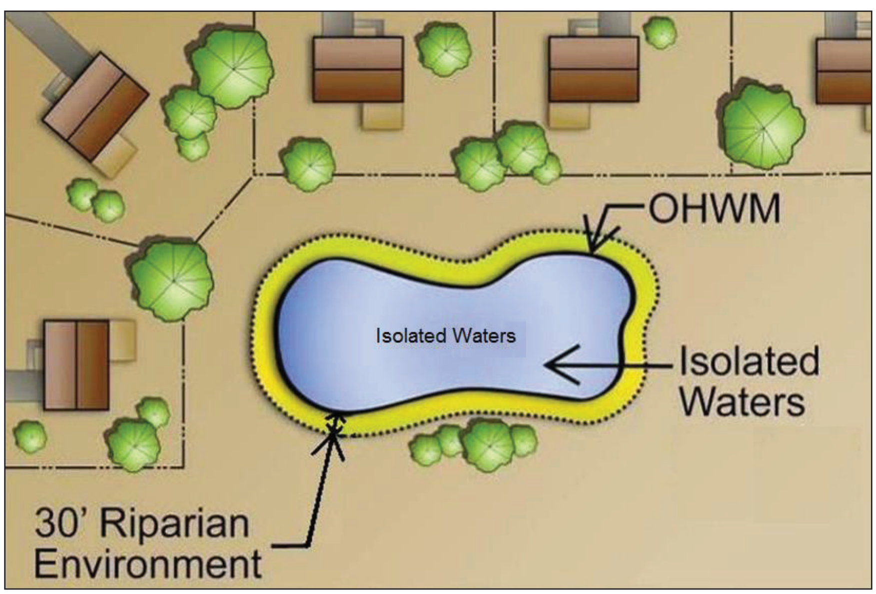


Figure 6.15. Riparian Environment for an Isolated Waters that does not Qualify as Wetlands

The limit of the **riparian environment** is 100 feet from the **OHWM** for any **Jurisdictional Waters of the US** or for any **isolated waters** that do not qualify as **wetlands** and which are identified as:

- **Biological Stream Characterization** (**BSC**) of “A” or “B” according to the latest edition of the **Illinois Environmental Protection Agency’s** ***Biological Stream Characterization****: Biological Assessment of Illinois Stream Quality*.

- **Biologically Significant Stream (BSS)**, which is a stream with a Biological Diversity or Integrity of “A”, “B”, or “C” according to the latest edition of the Illinois Department of Natural Resource’s (IDNR) Office of Resource Conservation: *Biological Stream Ratings for Diversity, Integrity and Significance.*

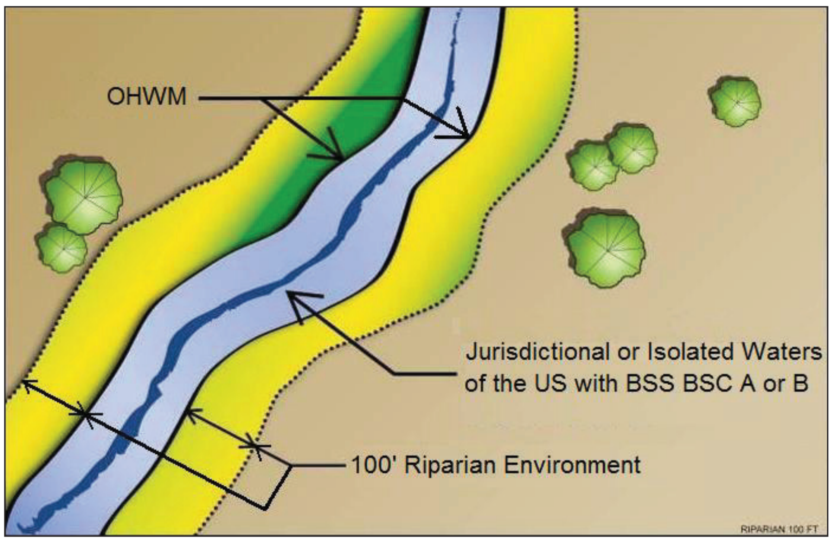


Figure 6.16. Riparian Environment Limits for Streams with a BSC Classification of "A" or "B” and BSS streams

The Illinois Department of Natural Resources - Office of Resource Conservation *Biological Stream Ratings for Diversity, Integrity and Significance* is available at:

www.dnr.state.il.us/orc/BioStrmRatings/

Riparian Environment Functions

Riparian environments are defined in two ways, by function and proximity to waters of the US and **isolated waters** (§606.1 of the WMO). It is the function of the **riparian environments** that is to be protected. It is the responsibility of the co-applicant to document the functions that each identified **riparian environment** has on the **development site**.

The following provides examples of riparian functions that should be considered.

- Reducing **flood** flowrates, velocities, and volumes;
- Minimizing **erosion** and promoting bank stability of streams, **lakes**, ponds, or **wetland** shorelines;
- Helping to control **sediment** from upland areas by filtering and assimilating nutrients

discharged from surrounding uplands;
- Has overhanging vegetation that helps to cool stream flow; and/or
- Providing nutrient uptake that may reduce algal blooms and subsequent depressed levels of dissolved oxygen in-stream.

The presence and extent of **riparian environments** are to be identified by the permit applicant. The applicant should identify the function and quality of **riparian environments**. If a **riparian environment** is present on the subject **parcel**, the applicant is encouraged to obtain the assistance of an environmental scientist to delineate the boundaries of the **OHWM**. The **Corps** maintains a list of consultants who perform these services. Inclusion on this list does not constitute a recommendation, endorsement, or certification of its qualifications or performance record.

Exempt Riparian Areas

Some areas that meet the requirements to be considered **riparian environment**s are exempt from regulation because they are manmade. Areas that were excavated out of upland conditions or created by artificial **hydrology** are generally not regulated by the WMO as a **riparian environment** (§606.3 of the WMO). While man-induced waters may not be regulated under the WMO, they may be regulated by other federal, state, or local **municipalities**. The **Corps** and USEPA reserve the right on a case-by-case basis to determine that a particular water body is a **Jurisdictional Waters of the US**.

The following **riparian environments** are exempt from the **riparian environment** requirements of the WMO:

1. Roadside ditches created by excavation for the purposes of **stormwater** conveyance;

2. Channels or bodies of water created by unfinished **development** activities; and

3. Channels or bodies of water created by the construction of **stormwater facilities** for the purposes of **stormwater** management.

RIPARIAN ENVIRONMENT MITIGATION (§607)

Definition of Adverse Impacts

Adverse impacts to the function of **riparian environments** must be mitigated. Appropriate mitigation must be included in a **site** mitigation plan, which is part of the permit submittal (§306 of the WMO).

Adverse impacts to **riparian environment** functions are defined as:

1. Modification or relocation of streams and channels;

2. Significant changes to quantity, quality, or distribution of flows draining to any adjacent

wetlands or waters; and

3. Damage to vegetation that overhangs, stabilizes, provides overland flow filtration, or shades stream channels, **wetlands**, or impoundments that normally contain water.

The removal of invasive vegetation is not considered to be destruction or damage of vegetation. The removal of vegetation and downed trees impeding drainage or removal of invasive vegetation is excluded from the WMO requirements when included as part of a **District** recognized program or project for stream **maintenance**, **stabilization**, restoration, or enhancement.

Riparian Environment Mitigation

Impacts to **riparian environments** are mitigated through the replacement or enhancement of impacted functions and values. Therefore, a narrative must be provided that identifies the existing **riparian environment** functions.

<u>Mitigation Approaches</u>

The functions of the impacted **riparian environment** may be mitigated by enhancing the functions and values of the remaining **riparian environment**. For example, if the existing **riparian environment** were a fallow field and provided limited soil **stabilization**, **sediment** filtration, and pollutant assimilation functions, those functions could be enhanced by re-vegetating the remaining **riparian environment** with native deep rooted vegetation that increases the soil **stabilization**, **sediment** filtration, and pollutant assimilation functions.

Riparian environment averaging may also be used to mitigate impacts. Averaging is reducing the width of the **riparian environment** in one area while increasing the width in another without reducing the aggregate area. This is allowable if the applicant demonstrates that the averaging will not adversely affect the **riparian environment** functions and values and that the **riparian environment** width is not reduced in any location by more than 50% or to less than 30 feet. Figure 6.17 illustrates this concept:

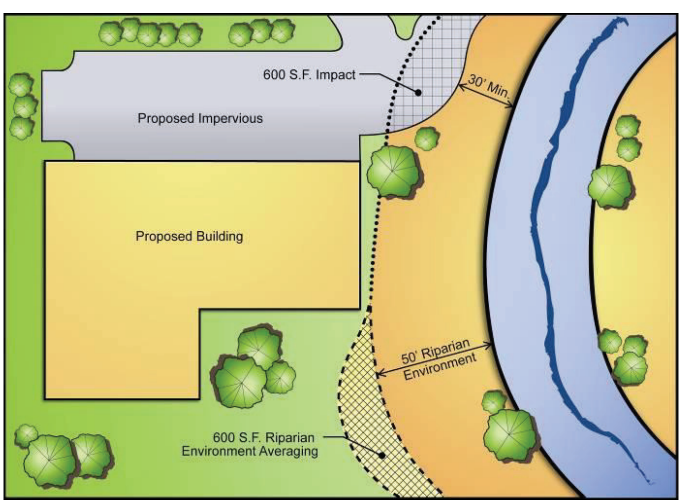


Figure 6.17. Riparian Environment Averaging

Channel Relocation and Stabilization Practices

The following requirements pertain to channel relocation and **stabilization** practices:

Avoidance of Impacts to Natural Streams and Channels

When practicable, impacts to natural streams and channels should be avoided. Natural streams and channels provide greater benefits than urban hard-armored streams and channels. Therefore, the WMO requires avoidance of these areas.

Similar to the **wetland** requirements, the phrasing of “when practicable” is understood as available and being capable of being implemented after taking into consideration cost, existing technology, and logistics in light of the overall purpose of the **development** (see the avoidance and minimization sequencing discussion in §604). However, natural streams and channels have often been degraded due to **erosion** from urban **runoff**. Therefore, stream restoration and enhancement projects are exempt from this requirement, as the goals of these projects are to provide enhanced functions and values.

Naturalizing New or Relocated Channels

If a channel is completely or partially relocated, the newly created portion shall be constructed in a manner which will allow naturalizing to occur, including but not limited to, meandering, pools, or riffles where practicable.

Constructed in Dry Conditions

When feasible, new or relocated channels shall be built under dry conditions through the diversion of the normal flow within the channel. All items of construction (including establishment of vegetation) shall be completed prior to diversion of water into the new channel.

Building new or relocated channels under dry conditions minimizes and controls suspended **sediment** and degradation of downstream water quality.

Erosion and Sediment Control Practices

An approved and effective **erosion** and **sediment control practice** to minimize and control suspended **sediment** and degradation of downstream water quality must be installed before excavation begins. The installed practices must be maintained throughout the construction period and conform to the requirements of WMO Article 4.

There are numerous methods and proprietary products to control **erosion** and **sediment** during construction of streambank **stabilization** projects. Some of these practices include, but are not limited to, **silt fence** at the toe of the slope, turbidity curtains, stream draw down, by-pass pumping, diversion channels, and coffer **dams**. See Article 4 for appropriate **erosion** and **sediment control practices**.

Meeting Channel Modification Requirements

Any channel modifications shall meet all other requirements in the WMO and **TGM**, including the **floodplain** and **floodway** requirements outlined in §601 and §602. See Article 3 for

floodplain and **floodway** submittal requirements.

Length of New or Relocated Channel
The length of any new or relocated channel shall be greater than or equal to the length of the disturbed channel.

Meandering channels are generally longer than straightened channels. Meandering channels can offer more physical stability and physical habitat diversity than are typically found in a straightened stream corridor. This requirement is to ensure that channel straightening does not occur.

Withstanding All Events up to the Base Flood without Increased Erosion
Streams and channels shall be expected to withstand all events up to the **base flood** without increased **erosion**. Hard armoring of banks with concrete, bulkheads, rip-rap, and other non-natural materials shall be avoided where practicable. Hard armoring shall be used only where **erosion** cannot be prevented by use of bioengineering techniques or gradual slopes. Such armoring shall not have any adverse impact on other properties nor shall it have an adverse impact upon the existing land use.

Natural streams and channels provide greater benefits than hard-armored streams and channels. Similar to the **wetland** requirements, the phrasing of “where practicable” is understood as available and being capable of being implemented after taking into consideration cost, existing technology, and logistics in light of the overall purpose of the **development** (see the avoidance and minimization sequencing discussion of the **TGM**). When hard armoring is proposed where **erosion** cannot be prevented by use of approved methods, documentation must be provided showing the need for hard armoring techniques.

Replanting for Stability
All **disturbed areas** must be replanted for stability with native vegetation where appropriate.

Stormwater Outlets Impacting Riparian Environments

Stormwater outlets discharging into a channel shall be designed with appropriate water quality control practices and proper energy dissipation or scour protection. See Article 4 appropriate water quality and **sediment** and **erosion** control measures.

Riparian Environment Mitigation Plan Requirements

A **riparian environment** mitigation plan shall be developed by the applicant and meet the requirements of Article 9. This plan shall include:

1. Mitigation area design;

2. Plan sheets;

3. Construction phasing;

4. A monitoring plan; and

5. A **maintenance** plan.

This plan may be combined with other impact and mitigation plans if **wetland** or buffer impacts are proposed.

Each **riparian environment** mitigation plan must have a drawing that depicts the location and extent of the **riparian environment** mitigation as well as **riparian environment** that is impacted on the **site**, planting zones, and temporary and permanent access locations. A summary table shall be included on this drawing that includes the acreage to be disturbed and the acreage to be mitigated.

The mitigation plan shall include specifications for construction. These include but are not limited to: specifications for rough and final grading, types of soils, soil handling methods, plant materials, scientific and common names, rates of seeding or spacing, source, storage, and installation methods.

The **maintenance** plan shall at a minimum include a description of each **maintenance** task proposed, expected effect, means of measuring its success, and an annual work schedule including the time of year each task will be performed.

The monitoring plan shall establish performance standards for the **riparian environment** mitigation. Performance standards are predetermined goals for guiding and measuring mitigation success. The monitoring plan shall identify the party(s) responsible for monitoring, the data to be collected and reported, how often and for what duration, the assessment tools and/or methods to be used for data collection, and the format for reporting monitoring data and assessing mitigation success based upon the proposed performance standards.

Riparian Environment Monitoring and Maintenance

The **District** or **authorized municipality** will require that the applicant provide the annual monitoring reports on the status of the constructed mitigation measures for five years or until such time that the performance criteria has been met. The **District** or **authorized municipality** may also require the applicant to undertake remedial action to bring the area into compliance with the mitigation plan. Changes to the mitigation, **maintenance** and monitoring plan may be approved by the **District** or **authorized municipality** as necessary.

Mitigation measures in **riparian environment**s shall include required provisions for long-term **maintenance**.

Requirements for Outfalls

For all new and reconstructed **outfalls** to any **waterways**, including Lake Michigan, require a **Watershed Management Permit**. For **outfalls** to **waterways** located within the City of Chicago, a **Facility Connection Authorization** is also required.

Each **outfall structure** must be designed with energy dissipation. **Outfalls** constructed within **wetlands, wetland buffer**, and **riparian environments** will be subject to those applicable requirements of the WMO. The **outfall** and energy dissipation must be designed such that no downstream **erosion** or **flooding** results from the discharge. Article 4 of the WMO requires that the **stabilization** practices be installed as soon as practicable in those portions of the **site** where construction activities have temporarily or permanently ceased.

REFERENCES

Compensatory Mitigation for the Losses of Aquatic Resources, April 2008. Available at: http://www.mitigationbanking.org/pdfs/2008finalcompensatorymitigation.pdf

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1. Vicksburg, MS: US Army Engineer Waterways Experiment Station.
Available at: http://el.erdc.Corps.army.mil/wetlands/pdfs/wlman87.pdf

Environmental Laboratory. September 2008. *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region*. Technical Report ERDC/EL TR-08-27. Vicksburg, MS: US Army Engineer Research and Development Center
Available at: http://el.erdc.Corps.army.mil/elpubs/pdf/trel08-27.pdf

Federal Emergency Management Agency (FEMA), May 2001. *Technical Bulletin 10-01: Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*.
Available at: http://www.fema.gov/media-library-data/20130726-1511-20490-3169/tb1001.pdf

Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR) Floodplain Model Ordinance. Available at: http://dnr.state.il.us/flood/model.htm

The Interagency Coordination Agreement (ICA) on Mitigation Banking Within the Regulatory Boundaries of the Chicago District, Corps of Engineers.
Available at: http://www.lrc.Corps.army.mil/co-r/MBICAJun2008.pdf

Kane County Technical Reference Manual. Available at: http://www.countyofkane.org/FDER/Documents/waterOrdinances/technicalManual.pdf

Lake County Technical Reference Manual. Available at: http://www.lakecountyil.gov/Stormwater/FloodplainStormwaterRegulations/WDOandTRM/Pages/TechnicalReferenceManual.aspx

Regional Internet Bank Information Tracking System (RIBITS)
Available at: http://www.lrc.Corps.army.mil/co-r/ribits.htm

USDA Natural Resources Conservation Service. 1994. *National Food Security Act Manual, third edition* (as amended). Washington, DC. Available at: http://www.nrcs.usda.gov/programs/compliance/index.html

ARTICLE 7: REQUIREMENTS FOR SEWER CONSTRUCTION

Introduction

For the protection of existing and future infrastructure, and in the **interest** of public health, all **qualified sewer construction** in **Cook County** is subject to regulation requiring formal approvals and permitting. Regulating sewer projects promotes minimum design and construction standards, provides a data repository of underground sewer infrastructure, and minimizes the risk to existing public and private infrastructure by requiring research, preparation, and coordination prior to a contractor beginning work.

GENERAL SEWER CONSTRUCTION REQUIREMENTS (§700)

Approximately 125 agencies (**municipalities**, sanitary **districts**, townships, and one utility company) are tributary to the **District's** collection system of interceptor sewers. These agencies are relieved of the responsibility to own and operate a **sewage** treatment plant and benefit from the economy of scale of large, regional **sewage** treatment plants. Older **municipalities** are built upon a **combined sewer** system that conveys domestic **sewage**, **industrial wastes**, and **stormwater runoff** to the **District** collection system. **Municipalities** constructed after 1945 are generally on a **separate sewer** system where one pipe conveys domestic **sewage** and **industrial wastes** with a separate pipe for the collection of **stormwater runoff**. The **District** maintains a ***Combined Sewer*** *Atlas* to show what areas it considers to be on a **combined sewer** system and what areas considered to be on a **separate sewer** system.

The **District** has the right to annex property within **Cook County** into the **District** Corporate limits. This is done by an Act of the State Legislature. The **District** also has the right to enter into Sewer Service Agreements with **municipalities** that are within **Cook County** and the **District's** corporate limits and also lie in an adjoining county such as Lake, DuPage, or Will Counties. Areas that are annexed after July 9, 1998 must pay a **Connection Impact Fee** to the **District** for the area to be served.

The **District** follows the design standards for public sewer systems as regulated by Title 35 of the State of Illinois Administrative Code, Subtitle C, Part 370. While the **District** does not regulate plumbing of **buildings** it may ask for plumbing plans to determine where waste flows are originating from and how they are routed through the **building**.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

QUALIFIED SEWER CONSTRUCTION (§701)

The **District** collects, treats, and disposes of **sewage** from approximately 95% of the land area of **Cook County**. The suburbs of Chicago Heights, University Park, Park Forest, and the majority of Homewood are tributary to the Thorn Creek Basin Sanitary District (TCBSD); construction and replacement of **sanitary** or **combined sewers** in those communities should be coordinated through TCBSD. Contact information is available on-line at the following website: www.thorncreek.dst.il.us. The far northwest portion of **Cook County** (Barrington and the areas immediately east of it) is also not in the corporate limits of the **District** and **sanitary sewer** construction would be regulated by the appropriate local agency. Most of this area is currently on septic and is not tributary to a **sewage** treatment plant. However, a **Watershed Management Permit** is still needed for **development** in these areas of **Cook County**, even when they are not located within the corporate boundaries of the MWRD or are not tributary to its treatment plants (WMO §200.1) Service laterals for **single-family homes** and multi-family homes less than 3 units within the corporate limits are not regulated by the WMO.

Construction or modification of **storm sewers** in a **combined sewer area** and construction of **storm sewers** in a **separate sewer area** that discharge to a **District** facility are considered **qualified sewer construction** and require a **Watershed Management Permit**. Refer to the **qualified sewer construction** flowchart provided as Figure 7.1 for additional guidance. A permit from the **District** is also required for **development** that impacts **District** property; a flowchart that navigates applicants through **District** impacts is provided as Figure 7.2.

A **Watershed Management Permit** is required for cured-in-place pipe (CIPP) lining of public sewer systems. CIPP lining of private sewer systems is considered **non-qualified sewer construction**. Routine **maintenance** performed on an existing sewer system, public or private, such as grouting, jetting, cleaning, and root cutting is not regulated by the WMO.

QUALIFIED SEWER CONSTRUCTION REQUIREMENTS (§702)

Qualified sewer construction is considered all public and private new sewers and new sewer connections, exterior to the **building envelope**, including sewer repair and sewer replacement. Any construction that is considered **qualified sewer construction** will require a **Watershed Management Permit**. The following summarize the **District's** requirements for **qualified sewer construction**:

A. Single-Family Home

A **service sewer**, also referred to as a lateral, that serves a **single-family home** or two-unit **building** to connect to the public sewer system does not require a **Watershed Management**

Permit from the **District**. However, it does require a **Watershed Management Permit** if the public sewer must be extended to serve that property.

B. Residential Subdivision

A **residential subdivision** of **single-family homes** or townhomes or **multi-family residential** units requires a **Watershed Management Permit**.

C. Multi-Family Residential Sewer

A **development** that consists of a single **building** or **structure** that has more than two individual dwelling units requires a **Watershed Management Permit**.

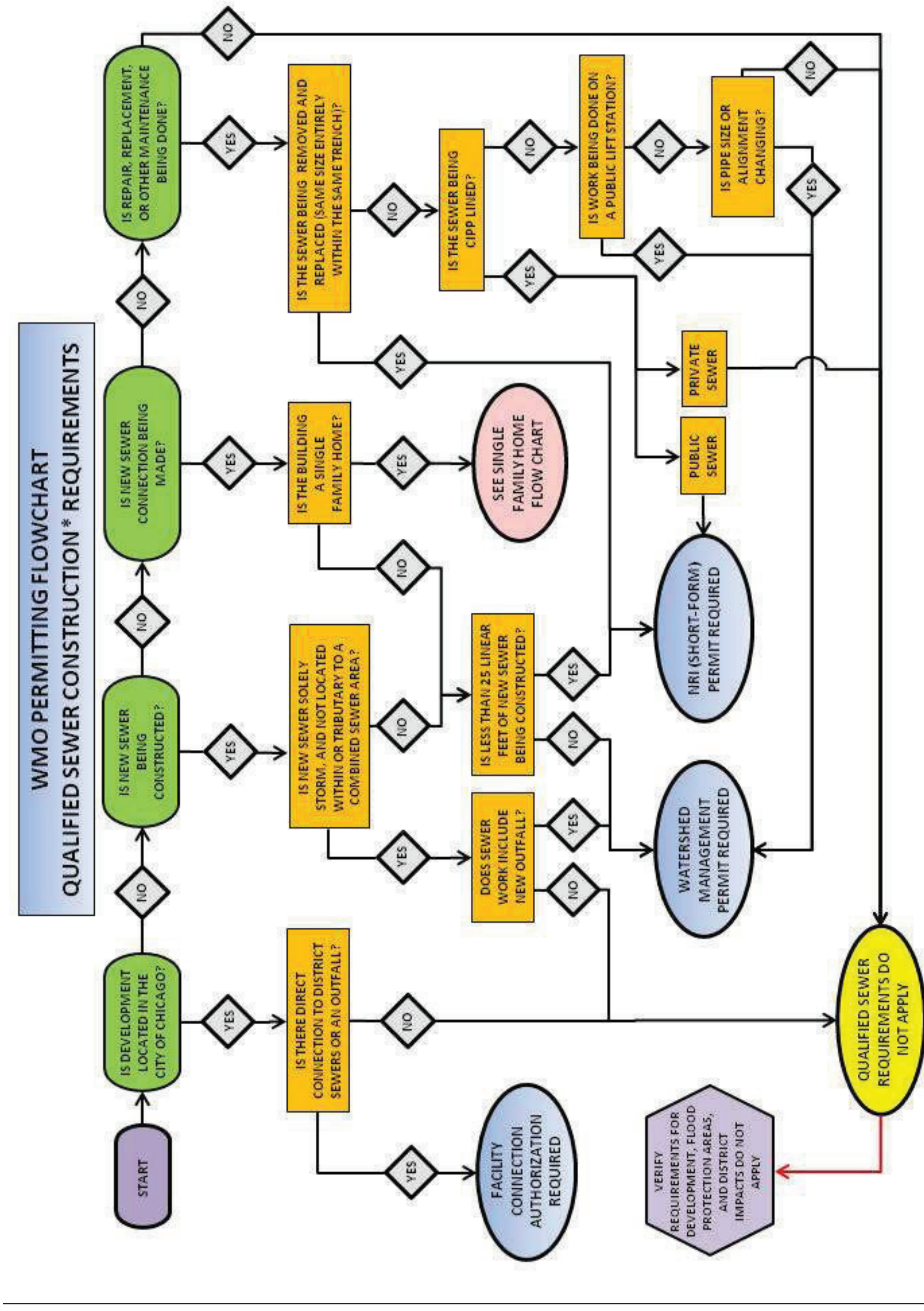
D. Non-Residential Service Sewer

Commercial, recreational, and industrial properties must apply for and receive a **Watershed Management Permit** before they can be constructed and discharge into the public sewer system. All such properties will require an inspection manhole that isolates the **sewage** being discharged from the **building** before it leaves the private property. The inspection manhole should be located at least 5 feet from the perimeter of the **building** and not be in a driveway or traveled area. A manhole into which a force main discharges cannot be considered an inspection manhole.

E. Public Lift Station/Force Main

The following items are required for a proposed lift station:

- Schedule E – Lift Station (Schedule E is only required for publicly owned lift stations serving multiple service areas; an original PE Seal and signature is required on the Schedule E form).
- Details of Construction;
- Service Area Map;
- Hydraulic design calculations;
- Present and future population equivalents (PE);
- Pump System Curves, Characteristic Curves, Operation Point;
- Wet Well Capacity and Detention Time calculations (detention should be between 10 and 30 minutes);
- Buoyancy Calculations for the lift station;
- Lift stations are to be located a minimum of 25 feet horizontally from any water main; and
- New lift stations shall not be located within the **regulatory floodplain** or have access openings and vents below the **Flood Protection Elevation (FPE).**



*See definition of qualified sewer construction in Appendix A of the WMO.

Figure 7.1. Qualified Sewer Construction Flowchart

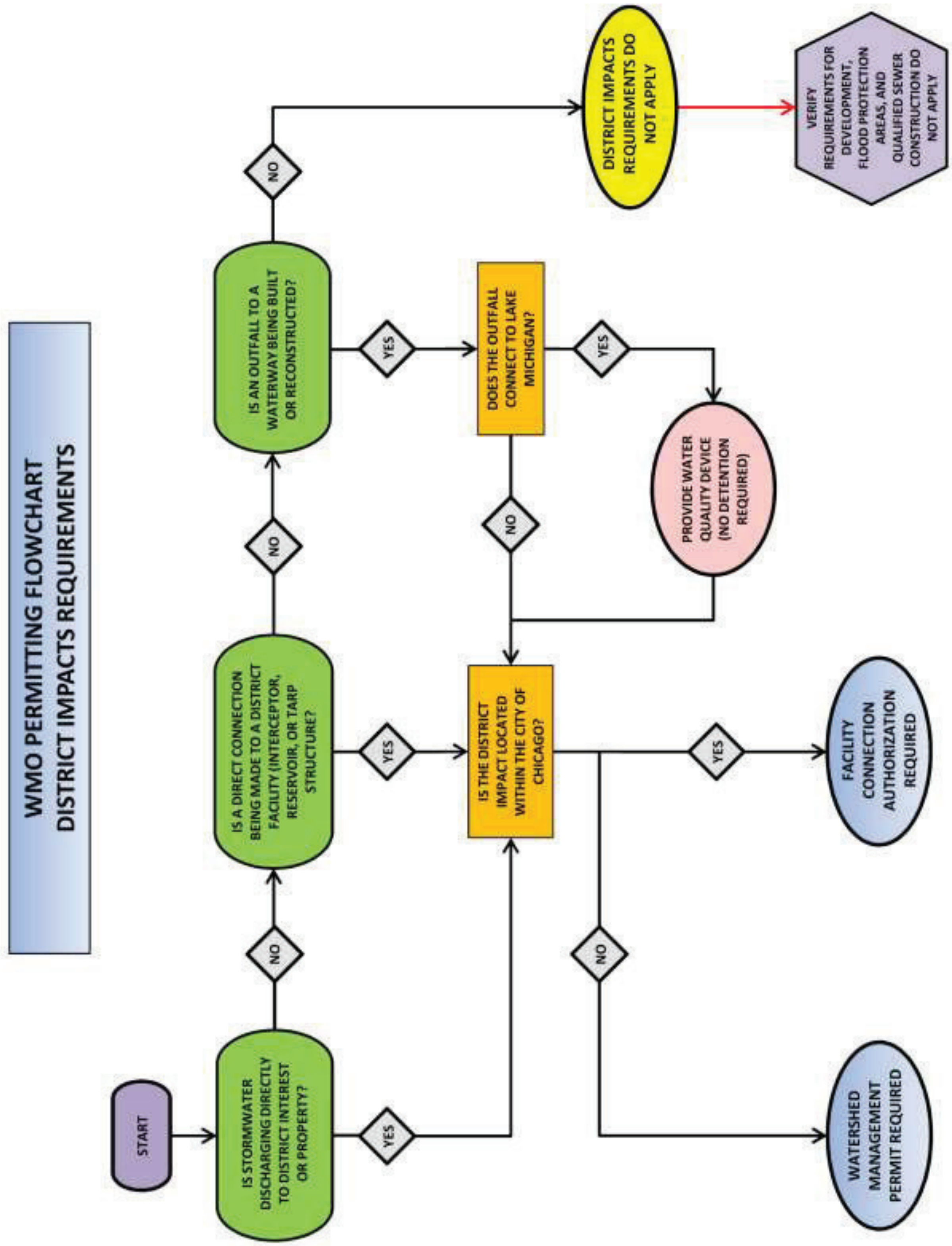


Figure 7.2. District Impacts Flowchart

The following items are required for a proposed force main:

- A plan and profile drawing are required identifying high and low points and point of discharge;
- For a public force main the minimum diameter is four inches or a pipe size that provides a self scouring velocity of 2 feet per second;
- Thrust blocks are required for open cut installations;
- Air relief valves are required on the high points;
- Blow off valves are recommended on the low points;
- Submit calculations addressing items 2, 4, 5, 6 of Schedule E;
- Submit service area map with present and future population equivalents (PE); and
- Submit pump curves and systems curves.

The lift station shall be designed and operated so that only one pump is in operation at a time. The second pump should have the capacity for the service area, and will serve as a backup to be placed in operation only when the first pump is not in operation. Simultaneous operation of both pumps is prohibited. If the pump station has three or more pumps, multiple pumps may operate simultaneously; however, the maximum discharge rate may not be exceeded at any time.

PLC control logic electrical schematic diagrams must be submitted as part of the plan set. The control logic must demonstrate that the pumps cannot be operated simultaneously.

In addition, the applicant must also:

- Verify the size of the force main is not less than 4 inches for public systems;
- Provide wet well size calculations;
- Verify the detention/retention time in the wet well is calculated and provided between 10 and 30 minutes. The cycle time of the pumps should not be more than six times per hour;
- Verify that air relief valves are provided on the high points of the force main;
- Include information or calculations for future growth (PE and pump curves);
- Identify Pump Horsepower and Impeller type and which system curve is applicable;
- Verify that the operating head is not too close to the shutoff head.

If an existing lift station is being replaced, any increase in the pump capacity must be justified, such as by service population increase (and a map showing this must be provided to support this). The **District** does not allow increased pump capacity to accommodate excessive Infiltration and Inflow (I&I) conveyed by **sanitary sewers** upstream of the Lift Station. In addition, force main to force main connections are discouraged.

For private lift stations, the engineer must provide the force main profile and Special Conditions will be attached to the permit. A private lift station serves a sole property even if that property is publicly owned. A separate inspection manhole shall be provided upstream of the wet well for any **non-residential** facilities tributary to the private lift station.

For **stormwater** lift stations, check downstream conditions that may limit or constrict flow such as culverts under a roadway.

F. District Interceptor, TARP and other Direct Connections to District Facilities

- Procure applicable **District record drawings**, design standards, and specifications relevant to the proposed connection.
- Provide a map of the service area for the proposed sewer.
- Provide a detail of the connection to the **District** facility including size, pipe material, details of **District structure**, and proposed **structure**.
- Provide an auxiliary manhole upstream of the proposed connection.
- Before construction commences, provide calculations prepared and sealed by a Structural Engineer licensed in the State of Illinois for excavation support systems that may be required.
- Provide a bypass pumping plan, if required.

G. Outfall Connection

For proposed **outfall** connections, the following must be provided:

- Provide a map of the service area for the proposed **outfall**.
- Provide a natural or mechanical flow-through device (see Lake Michigan Outfall Water Quality Structure Typical Detail)**.**
- Provide a headwall for the **outfall**, a precast flared end Section may be provided for **outfalls** that are 15 inches or less in diameter such as **IDOT** Standard 542301. For larger **outfalls**, a cast in place headwall must be provided – such as **IDOT** Standard 542101 – or be part of the permanent dock wall.
- Energy dissipation by the use of a level spreader or rip-rap placement must be provided when discharging at a grade.
- Details of the energy dissipation system must be provided.
- Consider if a backflow prevention device is required when the receiving **waterway** is at **flood** stage. Backflow preventers are required for stormwater detention systems in separate sewer areas with flood control projects and also in combined sewer areas where an open detention pond is proposed.
- Provide WMO Schedule O (see §608 of the WMO for **outfall** requirements).

- Should the **outfall** pierce an existing dock wall, such as a driven sheet pile wall, a detail of the wall penetration must be prepared and sealed by a Structural Engineer licensed in the State of Illinois.
- A Special Condition requiring the **owner** of the **outfall** to obtain a **National Pollutant Discharge Elimination System (NPDES)** permit from the **IEPA** is attached to the permit.

H. Treatment and Pretreatment Facilities (such as Treatment Plants and Oxidation Ponds)

Provide technical data on the operation of the facilities including criteria and calculations, such as the following:

- Process Flow Schematics.
- Provide Schedule G (or **IEPA** Schedule J).
- Provide a flow meter to measure water into the facility.
- Provide a sampling chamber or inspection access where samples of the effluent can be taken.
- Provide a surety bond for the **maintenance** and operation of the facility.

I. Septic Systems

The **District** does not regulate the design, construction, or **maintenance** of septic systems for **sewage** disposal serving a home or **building**. When allowed, the local authority would be the permitting agency for such an installation. In unincorporated **Cook County**, the County's Department of Public Health would regulate and permit such an installation. Septic systems cannot discharge their effluent to a sewer tributary to the **District's** interceptor sewer system.

When disconnection from a septic system and sanitary service connection is made, the existing septic system must be abandoned by pumping out any residual sludge, completely filling the abandoned septic tanks with granular material such as **IDOT** FA 2 or CA 6, and plugging the ends with grout. Alternatively, the septic system could be completely removed. If the existing tank is left in place, the bottom slab should be punctured to allow water to drain out, and the ends plugged with grout. Connections and piping to the new **sanitary sewer** system must be made upstream of the septic tank and must be watertight.

J. Sewer Construction in Floodplain

Provide watertight, bolt down covers on **sanitary** or **combined sewer** manholes that may be inundated during a **flood** condition. This would be considered any area that is less than two feet above the **Base Flood Elevation**, **Flood Protection Elevation**, or the detention system's High Water Level. The **Flood Protection Elevation (FPE)** is defined as the **Base Flood Elevation** plus two feet of freeboard.

FACILITY CONNECTION AUTHORIZATION (§703)

Within the City of Chicago, a **Facility Connection Authorization** (**FCA**) must be prepared for connections made directly or indirectly to **District** facilities. The **FCA** is signed by an authorized representative of the Department of Water Management. Projects that cross **District** property to reach a **waterway** require an easement from the Law Department's Real Estate Section. The technical details would be the same as listed under subsection ***F. District Interceptor, Tarp and other Direct Connections***.

THE SEWER CONSTRUCTION PROCESS

Starting the Project

First, identify where the project is located and which public sewer the **sewage** will discharge to. The **municipality** that owns the public sewer is the "**permittee**." The property **owner** whose **building** or facility is discharging the **sewage** is the "**co-permittee**." There are situations where the **sewage** discharges directly to a **District** interceptor sewer, generally known as a "Sole **Permittee**." There are locations where **sewage** and/or **stormwater** flow through more than one **municipality's** sewer before it reaches the **District** interceptor or the receiving stream. In such cases an additional Page 7 and Page 8 are required indicating that the **municipality** is aware and agrees to the project and certifies that their sewer system has adequate capacity. Information about existing **Sewerage System Permits** that may be helpful can be obtained by forwarding an email to the head of the Local Sewer System Section and requesting that a search of the permit data base for a given location be conducted. If a large number of permits are involved, the applicant will be asked to go the Stickney Field Office and review the permits to determine what is relevant to the project.

Identify if the project is in a **combined sewer area** or a **separate sewer area**. The **District** maintains an atlas that defines the areas considered to have been developed on a **combined sewer** system. Some older **municipalities** have done partial separation by **building storm sewers** for roadway drainage, but those **municipalities** are still considered to be on a **combined sewer** system.

Identify whether the project is residential, commercial, institutional, or industrial. The amount of **sewage** to be generated from the project is calculated by using the chart in the State of **Illinois Recommended Standards for Sewage Works** (Title 35 Part 370), Appendices A and B. It is assumed that, on average, a **person** needs 100 gallons of water per day to bathe, cook, flush the toilet and clean. It is also assumed that whatever water goes into a home or business comes out to the public sewer.

A Population Equivalent (PE) Calculation is required for any **building** connection or public sewer extension. The PE calculation may be written on Schedule C (Page 7) or it can be attached as a worksheet or shown on a drawing. Any time the PE calculation is not written on Schedule C (Page 7), a note should be written below the "PE** __" that indicates where the PE calculation is located (i.e. "See Attachment or See Sheet C1.1").

Design Flow. Average design flow for **sanitary sewers** shall be 100 gpcpd. Maximum design flow for **sanitary sewer** lines shall be determined by one of the equations indicated below; provided, however, that the maximum design flow for sewer laterals need not exceed 400 gpcpd and the maximum design flow for sewer mains and trunks shall not be less than 250 gpcpd.

Equation 1: $$Q = \frac{500}{\sqrt[6]{P}}$$

Equation 2: $$Q = 100\left(1 + \frac{14}{4+\sqrt{P}}\right)$$

Where,

Q = Maximum design flow, gallons per capita per day (gpcpd)
P = Population in thousands

The **sanitary sewer** is designed to flow under gravity to the public sewer with adequate slope to maintain a self-scouring velocity of 2 feet per second and with adequate earth cover, not less than 36 inches, to prevent freezing during the winter months.

Table 7-1. Minimum and Maximum Pipe Slopes by Size

Sewer Diameter *Inches*	**Minimum Slope** *Percent*	**Maximum Slope** *Percent*
6	1.0	33.0
8	0.40	22.0
10	0.28	15.0
12	0.22	11.0
15	0.15	8.3
16	0.14	7.8
18	0.12	6.5
21	0.10	5.1
24	0.08	4.2

Under special conditions, if detailed justifiable reasons are given, slopes slightly less than those required for the 2 feet per second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 30% of the diameter or greater for design average flow. Whenever such decreased slope are selected, the design engineer must furnish with his report his computations of the depth of flow in such pipes at minimum, design average, and design peak rates of flow. It must be recognized that decreased slopes may cause additional sewer **maintenance** expense and special linings or materials should be considered for corrosion protection. A letter from both the **permittee** and **co-permittee** acknowledging the increased **maintenance** due to the decreased slope shall be provided to the **District**.

Design of the Sewer System

The sewer system is laid out in the most efficient alignment possible keeping in mind the presence of other utilities such as potable water, natural gas, **storm sewers**, and electrical and telecommunications cables. The design of the sewer system is laid out concurrently with the grading plan to minimize any cut and fill earthwork the project may require and to ensure adequate earth cover over the **sanitary sewer**. Occasionally there are situations where an outlying **building** or public restroom for a park may be more efficiently served by constructing a grinder pump and a small 2-inch diameter HDPE force main that outlets to the public sewer system than constructing a gravity sewer.

Service Sewer

A **service sewer**, also known as a lateral, is defined as a sewer pipe receiving flow from a single **building**, connecting to a sewer main, and constructed on private property, except for street crossings. The maximum length of a **service sewer** shall not exceed 400 feet or 150 feet if access to a sewer cleaning truck is not available. If the length is exceeded, an intermediate manhole shall be built. Cleanouts may be used only for special conditions and shall not be substituted for manholes nor installed at the end of laterals greater than 150 feet in length. Two consecutive cleanouts in series are not allowed. When the **service sewer** connects to a sewer lateral of a size not larger than the size of the **service sewer**, a manhole shall be built at the point of connection. The minimum slope for a 6-inch diameter service line shall be one percent (1%).

Minimum design standards, and other requirements hereof, governing materials, joints, infiltration, workmanship and **maintenance** for sewer mains and laterals shall also apply to **service sewers**. Horizontal and vertical alignment of the **service sewer** shall be uniform and shall follow a straight line alignment. Any change in sewer alignment will require a structure at the change. There shall be no dips in the grade or fall of the line. Turns or bends required for the riser, if any, necessary to connect to the sewer wye or tee, shall be made with standard bends.

In those instances where the **service sewer** is partially constructed from the sewer lateral or main to a point other than the **building** to be served, the pipe shall be tightly plugged using a manufactured plug. The plug shall be pre-wired by the manufacturer so that it can be firmly secured in place.

Combined Sewer Areas

In areas designated as **combined sewer areas** on the **District *Combined Sewer*** *Atlas*, the following requirements shall apply:

a. *Separation.* Complete separation of **storm** and **sanitary sewers** shall be provided within the property lines.
b. *Down Spouts.* All down-spouts or roof drains shall discharge onto the ground or be connected to the **storm** or **combined sewer**. No down spouts or roof drains shall be connected to the **sanitary sewers**.
c. *Footing Drains.* Footing drains shall be connected to sump pumps, and discharge shall be made into **storm sewers**, **combined sewers** or drainage ditches. No footing drains or drainage tile shall be connected to the **sanitary sewer**. After December 31, 1970 all **new construction** shall conform to the requirements of this paragraph. No permit application will be accepted, nor any permits issued after December 31, 1970 to any **municipality** or local government unless said **municipality** or local government shall have adopted an ordinance reflecting the requirements of this paragraph and a copy of said ordinance shall have been filed with the **District**, or that the **permittee** and/or **co-permittee** shall agree to comply with the requirements of this article.
d. *Floor Drains.* Floor drains in **basements** shall be connected to sump pumps and discharged to the sanitary or **combined sewers**.
e. *Sump Pumps.* Sump pumps installed to receive and discharge **groundwater** or other **stormwater** shall be connected to the **storm** or **combined sewers** or discharge into a drainage ditch. Sump pumps installed to receive and discharge floor drain flow or other sanitary **sewage** shall be connected to the **sanitary** or **combined sewers**. A sump pump shall be used for one function only, either the discharge of **stormwater** or the discharge of sanitary **sewage**.
f. *Stormwater Detention.* A backflow preventer is required for all detention basins tributary to **combined sewers**. Required backflow preventers shall be inspected and exercised annually by the property owner to ensure proper operation, and any necessary maintenance shall be performed to ensure functionality. In the event of a sewer surcharge into an open detention basin tributary to **combined sewers**, the **permittee** shall ensure that clean up and wash out of sewage takes place within 48 hours of **the storm event**.

Separate Sewer Areas

In areas served by **separate sewer** systems, the following requirements shall apply:

a. *Down Spouts.* All down-spouts or roof drains shall discharge onto the ground or be connected to **storm sewer**. No down-spouts or roof drains shall be connected to the **sanitary sewers**.
b. *Footing Drains.* Footing drains shall be connected to sump pumps, and discharge shall be made into **storm sewers** or drainage ditches. No footing drains or drainage tile shall be connected to the **sanitary sewer**. After December 31, 1970, all **new construction** shall conform to the requirements of this paragraph. No permit application will be accepted, nor any permits issued after December 31, 1970, to any **municipality** or local government unless said **municipality** or local government shall have adopted an ordinance reflecting the requirements of this paragraph and a copy of said ordinance shall have been filed with the **District**, or that the **permittee** and/or **co-permittee** shall agree to comply with the requirements of this article.
c. *Floor Drains.* Floor drains in **basements** shall be connected to sump pumps and discharged to the **sanitary sewers**.
d. *Sump Pumps.* Sump pumps installed to receive and discharge **groundwater** or other **stormwater** shall be connected to the **storm sewer** or discharge into a drainage ditch. Sump pumps installed to receive and discharge floor drain flow or other sanitary **sewage** shall be connected to the **sanitary sewers**. A sump pump shall be used for one function only, either the discharge of **stormwater** or the discharge of sanitary **sewage**.
e. *Completion of **Storm Sewer** System.* The construction of the proposed **storm sewer** system shall be completed before the **sanitary sewer** system is put in service. When compliance with this requirement may cause an undue hardship to the **permittee**, the **permittee** shall notify the **District** and the **District** may waive this requirement if the conditions so warrant.
f. *Window Well and Area-Way Drains.* No window well or area-way drains shall be connected to the **sanitary sewer**.

Storm Sewers

Storm sewers are usually shallower and on a flatter slope than **sanitary** or **combined sewers**. The **storm sewer** is sized for a particular **storm event** (typically a 10-year **storm event**) and conveys **stormwater** to an outlet. The outlet is usually a **waterway** but there are cases where **stormwater** outlets to a **District** facility. The 100-year **storm event** is usually designed to flow over pavement and ground to a receiving **waterway**. It is important that there shall not be any **structures** in the path of the 100-year storm. An important aspect of **storm sewer** design is the spacing of inlets so the **stormwater** can actually be collected into the **storm sewer** during the rain event. Many **municipalities** have a standard frame and grate that they use based upon their past experience and the need to maintain inventory for repairs and **maintenance**. Any analysis of the **storm sewer** system inlets should be done with the standard grate that the **municipality** will specify.

Overhead Plumbing

All new **buildings** with **basements**, floors, rooms, or occupancy areas below ground level at the **building site** and served by a public or private sewer system, shall have overhead plumbing. No permit application will be accepted, nor any permits issued to any **municipality** or local government unless said **municipality** or local government shall have adopted an ordinance requiring overhead plumbing, and a copy of said ordinance shall have been filed with the **District**, or that the **permittee** and/or **co-permittee** shall agree to comply with the requirements of this section. A project that is a Sole **Permittee** will have to provide Schedule J, Overhead Plumbing.

Manholes, Drop Manholes

An exterior drop pipe must be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert, as provided in the State of Illinois Title 35, Part 370. The minimum diameter of any manhole shall be 48 inches. A rubber boot conforming to ASTM C-923, shall be provided for all connections between **sanitary sewers** and manholes, for all connections between **combined sewers** and manholes, and for all connections between **storm sewers** and **storm sewer structures** that are tributary to the **District's** collection system. The diameter of the drop pipe shall preferably be larger than, or of the same diameter as, the entering sewer. The minimum diameter of the drop pipe shall not be smaller than the diameter of the entering sewer by more than two nominal diameters (e.g. for 12", 15" and 18" entering sewer, the drop shall be 8", 10" and 12" respectively), provided that the minimum diameter of the drop pipe shall not be less than 8". If a smaller drop pipe is desired, design calculations and configurations shall be submitted for review and approval. The drop pipe shall be encased in concrete. The flow channel through manholes shall be made to conform in shape and slope to that of the sewers. A bench shall be provided which shall have a minimum slope of two (2) inches per foot. A drop manhole is required when a **storm sewer** discharges to a **combined sewer** and the change in elevation is 24 inches or more.

Protection of Water Mains

Water mains shall be protected in accordance with the requirements of the State of **Illinois Recommended Standards for Sewage Works** (Title 35 Part 370). Where a water main crosses above a sewer main lateral or **building** service, a minimum vertical separation of 18" shall be provided between the top of the lower pipe and the bottom of the upper pipe. Where the 18" vertical separation is not provided or where the sewer crosses above the water main, the sewer shall be designed and constructed of pipe equal to water pipe such as AWWA C900 or ASTM D-

3139/D-2241 or shall be encased in a steel casing pipe for a minimum distance of 10 feet on each side of the water main. Water mains must be located at least 25 feet from a sanitary lift station.

The **District** does regulate the use of pipe materials for sewers .The table below summarizes the most commonly used pipe materials and their ASTM, ANSI, and AWWA specification. The **District** will consider other pipe materials than those shown below but that material must be proposed to the **District** in writing and given written approval before the **Watershed Management Permit** can be approved.

All sewers tributary to the **District's** facilities are to have a gasketed joint to ensure water tightness. A solvent weld (commonly called a glued) joint is not acceptable to the **District**. If such a joint is provided, it must be encased in a concrete collar. Fused joints for directionally drilled HDPE pipe are acceptable.

Table 7-2. Pipe and Joint Materials

Material	Pipe Specification	Joint Specification
Vitrified Clay Pipe	ASTM C-700	ASTM C-425
Reinforced Concrete Sewer Pipe	ASTM C-76	ASTM C-443
Cast Iron Soil Pipe	ASTM A-74	ASTM C-564
Ductile Iron Pipe	ANSI A21.51	ANSI A21.11
Polyvinyl Chloride (PVC) Pipe 6-inch to 15-inch Diameter SDR 26 18-inch to 27-inch Diameter F/dy=46	 ASTM D-3034 ASTM F-679	 ASTM D-3212 ASTM D-3212
High Density Polyethylene (HDPE)	ASTM D-3350 ASTM D-3035	ASTM D-3261, F-2620 (Heat Fusion) ASTM D-3212, F-477 (Gasketed)
Water Main Quality PVC 4-inch to 36-inch 4-inch to 12-inch 14-inch to 48-inch	 ASTM D-2241 AWWA C900 AWWA C905	 ASTM D-2672 OR ASTM D-3139 ASTM D-3212 ASTM D-3212

Workmanship

As a minimum requirement all sewer pipes shall be laid in accordance with the applicable ASTM specification. The specifications for the construction of any sewers within the **District** shall not be less stringent than the latest version of the "Standard Specifications for Water and Sewer Main Construction in Illinois," adopted by a joint committee of the Illinois Society of **Professional**

Engineers, Consulting Engineers Council of Illinois, Illinois Municipal League, and The Associated General Contractors of Illinois. A copy of said specifications is obtainable from the organizations mentioned.

Directionally Bored Sewers

When the proposed sewer is to be constructed by the means of a directional bore, the sewer pipe must have restrained joints, the completed sewer shall have a minimum slope as specified in the table above plus 1% additional slope or greater, and the finished installation must be televised in the presence of the **District** inspector. Before the proposed directional bore sewer is connected to the public sewer system, it shall be air pressure tested, flooded, then drained by gravity and followed by televising for compliance with MWRD requirements covering pipe and joint material. If it fails to meet current requirements, the sewer shall be replaced.

Green Infrastructure

Underdrains in **combined sewer areas** that are tributary to the **District's** collection system must have a fabric filter cloth or sock. The underdrains must be at least 3.5 feet above the seasonal high **groundwater** elevation, which is established through soil borings performed on the **development site**.

Appurtenances

If the project is not solely residential there may be appurtenances that need to be provided. A restaurant or facility that prepares food will usually require a grease interceptor or basin.

An automobile dealership will have a vehicle service area that requires an oil water separator or triple trap to capture spilled oil and a vehicle wash area that will have a grit separator or mud basin to capture grit that is washed off vehicles. Discharge from a grit separator shall not flow through the oil water separator.

A commercial laundromat and apartment complexes with laundry rooms will require a lint trap to collect fibers that are present in the wastewater.

Swimming pools and spas have certain requirements about where backwash must discharge to and where the pool drain may discharge to.

Industrial facilities may have neutralization basins or pH adjustment processes to treat the wastewater before it is discharged into the public sewer.

The design engineer is encouraged to consult with the **District** in a pre-permit meeting to clarify any questions that he or she may have in connection with the permit requirements and to insure adequacy and conformance of the drawings to the intent of the WMO. In all cases which involve the design of treatment or pre-treatment facilities, direct connection to the **District** interceptors or facilities, and any project involving **industrial waste**, the design engineer should confer with the **District** prior to the preparation of the final plans. The transmittal letter submitting the plans must bear reference to prior consultations, if any.

Specific Requirements By Building Type

The following requirements are specific to certain types of **development**:

a. *Commercial & Recreational.* Check for whether an inspection manhole has been provided. Inspection manholes cannot be located in the roadway or in a driveway. The flow into the inspection manhole has to be gravity flow not from a force main. The inspection manhole should serve just one property. Verify that when an inspection manhole is provided on the property, approximately 5 feet from the **building**, only sanitary **sewage** flows though the manhole. Do not route **stormwater** through the inspection manhole, only **sewage**.
b. *Food preparation*. If the grease trap is inside, a detail is not required. If it is outside, a detail is required and must provide cleanouts for **maintenance** both upstream and downstream of the grease trap. Dishwasher discharges must bypass the grease trap.
c. *Auto service*. Inside/outside, a triple basin is required (provide detail if outside).
d. *Auto wash*. Inside/outside, a grit trap (mud basin) is required (provide detail if outside).
   Note: If the project includes a triple basin and a grit trap (mud basin), verify that the discharge from the grit trap (mud basin) bypasses the triple basin.
e. *Drainage from Multi-Story Parking Garages With Open Wall Areas.* Floor drains for multi-story parking garages that have open exterior walls where 50% or more of the floor to ceiling space is open must connect to the **storm sewer** system. All stories with less than 50% open exterior wall area must connect to the **sanitary sewer** system and shall have a triple basin before connection to the receiving system. In all cases, if the top story of the garage is open to the sky, that area must be connected to the separate **storm sewer** system within the property, even if the remainder of the **building** is connected to the **sanitary sewer** system as mentioned above.
f. *Laundry facilities.* Lint trap for laundromats, commercial laundries, and apartment complexes with laundry rooms.
g. *Swimming Pools.* For indoor swimming pools: filter backwash, deck drains, and main drain must discharge to the **sanitary sewer** system. No filter media shall be discharged into the sewers. If receiving **sanitary sewer** system has insufficient capacity for the main drain discharge, the main drain discharge may be routed to a **storm sewer**. Detailed plumbing plans must be submitted clearly showing the route of the flow of water from the above mentioned pool facilities to their point of discharge to a public sewer system. For outdoor pools: deck drains and main drains connect to the **storm sewer** system. Filter backwash pit discharges to a **sanitary sewer**. Outdoor pools shall be drained into the **storm sewer**

system. A note must be included on the plans that the pool will not be drained earlier than 24 hours following a rainfall.

Coordination with other District Ordinances

The design engineer must comply with the requirements of the **District's Sewage and Waste Control Ordinance**, Environmental Remediation Wastewater Ordinance and any other ordinances that may apply.

The design engineer will identify if the potential exists for **industrial wastes** to be discharged from the **building**. Should **industrial wastes** be produced (food processing, manufacturing, reclaiming of wastes, etc.) the appropriate Schedules F and G must be completed and provided with the **Watershed Management Permit** application. Schedule F is provided when the waste stream from the project is contaminated to the point that pretreatment or a Discharge Authorization from the Monitoring and Research Department (M&R) is required. The discharge of condensate from cooling towers does not require a Schedule F. If treatment or pretreatment facilities, such as neutralizing basins or metal precipitation are part of the project Schedule G must be provided as part of the **Watershed Management Permit** application.

Landfill Leachate and ***Groundwater****.* The discharge of landfill leachate (liquids that have percolated through landfill disposal wastes) and **groundwater** into a **sanitary** or **combined sewer** system will require a Discharge Authorization or a Special Discharge Authorization issued by the **District's** Director of Monitoring and Research or his designee, pursuant to the Environmental Remediation Wastewater Ordinance or the **Sewage and Waste Control Ordinance**.

Chemical Toilet Wastes. A permit from the Monitoring and Research Department must be granted. See Chemical Toilet Wastes Disposal Ordinance.

Coordination of **IEPA** Permits: Two (2) signed copies of the **Watershed Management Permit** may be accepted by the **IEPA** in lieu of certification of item 7 of **IEPA** WPC-PS-1.

Submittal of the Watershed Management Permit

Once the design is completed, the **Watershed Management Permit** application is submitted to the **District** for review. An initial Review Letter (RL #1) is generated and sent to the design engineer who responds to the RL #1 in writing. Any remaining deficiencies are summarized in a second Review Letter and sent to the designer who responds to RL #2 in writing. The cycle continues until all the comments are resolved and the **District** issues the **Watershed Management Permit**.

Filling out the **Watershed Management Permit** forms:

- On Schedule B, indicate the sewer length all the way to the face of the **building**. Indicate on Schedule B whether the sewer is a **storm sewer**, **sanitary sewer**, or **combined sewer**. **Combined sewers** are allowed only in a **combined sewer area**. **Storm sewers** and/or underdrains that are not tributary to the **District** interceptor sewer do not have to be shown, unless the **storm sewers** are proposed in a **combined sewer area** and are tributary to a **waterway**, in which case the **storm sewers** must be listed with a note stating that "**storm sewers** are tributary to sewer system that discharges to a **waterway.**"

- If an underground detention vault or pipe system are proposed and are tributary to an MWRD interceptor or to **TARP**, the vault/pipe system should be shown in the table, which would be the length of the detention vault or the overall length of the pipe system.

- Indicate the type of sewer pipe and joints by ASTM standard, this must also be shown on the plan sheets. Sewer size and length of run that are to be lined by CIPP or other methods should be indicated but no inspection fee is to be charged. If **storm sewers** to a **waterway** are to be constructed in a **combined sewer area**, indicate so on Schedule B.

- Schools, public roadways, fire stations, police stations, or parks are considered publicly financed projects. A convention center or athletic facility that generates revenue for the public entity may not be fee exempt.

- Provide a future service area map and provide corresponding PE calculations for a sewer intended to serve future areas.

Designers should cross reference this information with the plans to:

- Check the length, slope, diameter, and material with respect to the sewers proposed on the plans and the total length indicated on the Fee Payment Voucher form.

- Verify separation of **sanitary** and **storm sewers** before the property line in a **combined sewer area**. As tracing the route, the offsite sewer size should not decrease (onsite, **storm sewers** may be used for detention systems).

- Verify that wye connections are made from a smaller pipe to a larger pipe (i.e. a six-inch pipe wyes into an eight-inch pipe). Wye connections cannot be made with the same size pipe; provide a manhole or cleanout instead. Alternate cleanouts with manholes (two cleanouts in a row are not allowed).

Plans. Two copies of the plans no larger in size than 24" x 36" shall be submitted with the permit application. All plans shall show a “North” arrow, and shall be oriented so that the “North” arrow points upward or to the right hand side of the drawing. When the set of drawings submitted contains five or more sheets, an index shall be provided on the title sheet of the set, if any, or on the overall plan. Each sheet shall be designated by a proper title. The index sheet shall bear a date and shall show the name of the project and the name, address, email, and telephone number of the design engineer. When the set of plans contains less than five sheets, and no index is provided, each sheet shall be identified independently and shall show the name of the project, the date, the sheet title, and the name, address, and telephone number of the design engineer. The plans must contain the MWRD General Notes shown below and a routing map of the sewers and how they are tributary to the **District** facility. The plans shall be signed and sealed with original signatures and seals by a licensed **Professional Engineer** in the State of Illinois. If a plan index sheet is provided, that sheet must be signed and sealed.

MWRD General Notes (Sanitary Sewer)

1. The contractor shall take measures to prevent any polluted water, such as ground and surface water, from entering the existing sanitary sewers.
2. A water-tight plug shall be installed in the downstream sewer pipe at the point of sewer connection prior to commencing any sewer construction. The plug shall remain in place until removal is authorized by the municipality and/or MWRD after the sewers have been tested and accepted.
3. Discharging any unpolluted water into the sanitary sewer system for the purpose of sewer flushing of lines for the deflection test shall be prohibited without prior approval from the municipality or MWRD.
4. All sanitary sewer construction shall be in accordance with the *Standard Specifications for Water and Sewer Main Construction in Illinois* (latest edition).
5. All floor drains shall discharge to the sanitary sewer system.
6. All downspouts and footing drains shall discharge to the storm sewer system.

7. All sanitary sewer pipe materials and joints (and storm sewer pipe materials and joints in a combined sewer area) shall conform to the following:

Pipe material	Pipe Specifications	Joint Specifications
Vitrified Clay Pipe	ASTM C-700	ASTM C-425
Reinforced Concrete Sewer Pipe	ASTM C-76	ASTM C-443
Cast Iron Soil Pipe	ASTM A-74	ASTM C-564
Ductile Iron Pipe	ANSI A21.51	ANSI A21.11
Polyvinyl Chloride (PVC) Pipe		
6-inch to 15-inch Diameter SDR 26	ASTM D-3034	ASTM D-3212
18-inch to 27-inch Diameter F/dy=46	ASTM F-679	ASTM D-3212
High Density Polyethylene (HDPE)	ASTM D-3350 ASTM D-3035	ASTM D-3261 or F-2620 (Heat Fusion) ASTM D-3212, F-477 (Gasketed)
Water Main Quality PVC		
4-inch to 36-inch	ASTM D-2241	ASTM D-2672 or ASTM D-3139
4-inch to 12-inch	AWWA C900	ASTM D-3212
14-inch to 48-inch	AWWA C905	ASTM D-3212

8. All sanitary sewer construction (and storm sewer construction in combined sewer areas), requires stone bedding with stone ¼ ” to 1” in size, with minimum bedding thickness equal to ¼ the outside diameter of the sewer pipe, but not less than four (4) inches nor more than eight (8) inches. Material shall be CA-11 or CA-13 and shall be extended at least 12” above the top of the pipe when using PVC.
9. “Band seal” or similar non-shear flexible-type couplings shall be used in the connection of sewer pipes of dissimilar materials.
10. All manholes shall be provided with bolted, watertight covers. Sanitary lids shall be constructed with a concealed pickhole and watertight gasket with the word “SANITARY” cast into the lid.
11. When connecting to an existing sewer main by other than an existing wye, tee or an existing manhole, one of the following methods shall be used:
    - A circular saw-cut of sewer main by proper tools (“shewer-tap” machine or similar) and proper installation of hubwye saddle or hub-tee saddle.

- Remove an entire section of the pipe (breaking only the top of one bell) and replace with a wye or tee branch section.
- With pipe cutter, neatly and accurately cut out desired length of pipe for insertion of proper fitting, using "band seal" or similar couplings to hold it firmly in place.

12. Whenever a sanitary/combined sewer crosses under a watermain, the minimum vertical distance from the top of the sewer to the bottom of the watermain shall be 18 inches. Furthermore, a minimum horizontal distance of 10 feet between sanitary/combined sewers and watermains shall be maintained unless: the sewer is laid in a separate trench, keeping a minimum 18" vertical separation; or the sewer is laid in the same trench with the watermain located at the opposite side on a bench of undisturbed earth, keeping a minimum 18" vertical separation. If either the vertical or horizontal distances described above cannot be maintained, or the sewer crosses above the watermain, the sewer shall be constructed to watermain standards.
13. All existing septic systems shall be abandoned. Abandoned tanks shall be filled with granular material or removed.
14. All sanitary manholes, (and storm manholes in combined sewer areas), shall have a minimum inside diameter of 48 inches, and shall be cast in place or pre-cast reinforced concrete.
15. All sanitary manholes, (and storm manholes in combined sewer areas), shall have precast "rubber boots" that conform to ASTM C-923 for all pipe connections. Precast sections shall consist of modified groove tongue and rubber gasket type joints.
16. All abandoned sanitary sewers shall be plugged at both ends with at least 2 feet long non-shrink concrete or mortar plug.
17. Except for foundation/footing drains provided to protect buildings or perforated pipes associated with volume control practices, drain tiles/field tiles/underdrains/perforated pipes are not allowed to be connected to or tributary to combined sewers, sanitary sewers, or storm sewers tributary to combined sewers in combined sewer areas. Construction of new facilities of this type is prohibited; and all existing drain tiles and perforated pipes encountered within the project area shall be plugged or removed, and shall not be connected to combined sewers, sanitary sewers, or storm sewers tributary to combined sewers.
18. A backflow preventer is required for all detention basins tributary to combined sewers. Required backflow preventers shall be inspected and exercised annually by the property owner to ensure proper operation, and any necessary maintenances shall be performed to ensure functionality. In the event of a sewer surcharge into an open detention basin tributary to combined sewers, the permittee shall ensure that clean up and wash out of sewage takes place within 48 hours of the storm event.

Specifications. When specifications are prepared for the project separate from the plan sheets, submit one (1) copy of the specifications covering or relating to the sewer work, upon request. The specifications shall indicate the name of the project, and the name and address of the design engineer and shall contain a table of contents. The specifications table of content page shall be signed and sealed with original signatures and seals by a licensed Professional Engineer in the State of Illinois.

REFERENCES

American Concrete Pipe Association. 2011. Concrete Pipe Design Manual.
Available at: http://www.concrete-pipe.org/pdf/cp-manual.pdf

American Society of Civil Engineers. 2007. Manual of Practice No. 60, Gravity Sanitary Sewer Design and Construction

American Society of Civil Engineers. 2012. Manual of Practice No. 87, Design of Urban Stormwater Controls

American Society for Testing and Materials (ASTM) Standards. Available at: www.astm.org

American Water Works Association (AWWA) Standards. Available at: www.awwa.org

Ductile Iron Pipe Research Association. 1984. Ductile Iron Pipe Handbook.
www.dipra.org/publications

East Jordon Iron Works, www.americas.ejco.com

Illinois Department of Transportation. 2011. Drainage Manual. Available at:
http://www.dot.il.gov/bridges/pdf/IDOT%20DRAINAGE%20MANUAL.pdf

Metcalf & Eddy. 1972. Wastewater Engineering: Collection, Treatment, Disposal.

Metropolitan Water Reclamation District of Greater Chicago. Combined Sewer Atlas.
(Order from the Engineering Department Vault)

Metropolitan Water Reclamation District of Greater Chicago. MWRD Facilities Atlas
(Order from the Engineering Department Vault)

Neenah Foundry Company, www.nfco.com

Standard Specifications for Water & Sewer Construction in Illinois

State of Illinois Administrative Code: *Title 35: Environmental Protection, Subtitle C: Water Pollution Chapter II: Environmental protection Agency Part 370: Illinois Recommended Standards for Sewage Works*.

State of Illinois Plumbing Code. Available at:
http://www.ilga.gov/commission/jcar/admincode/077/07700890sections.html

Uni-Bell PVC Pipe Association. 1979. Handbook of PVC Pipe Available at: www.uni-bell.org

US Department of Agriculture Natural Resources Conservation Service. 2012. Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/il/technical/

US Department of Agriculture, Natural Resources Conservation Service. 2004. National Engineering Handbook. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprdb1043063

Water Environment Foundation. 1993. Design of Wastewater and Stormwater Pumping Stations, Manual of Practice.

ARTICLE 8: INFILTRATION / INFLOW CONTROL PROGRAM

INTRODUCTION (§800)

Major components of the **sanitary sewer** system are the public sewer mains (mains) and privately-owned sewer laterals (PSLs). Both contribute infiltration and inflow (I/I) to the **sanitary sewer** system. Significant I/I flow causes **sanitary sewer overflows** (**SSOs**), damage to private property through **basement backups** (**BBs**), loss of conveyance capacity and an increase in wastewater conveyance and treatment costs. The **sanitary sewer** system is designed to convey only wastewater, not wet weather flows or excessive **groundwater** that infiltrates into the sewers. When intense rain events occur and **groundwater** and **stormwater** enter the **sanitary sewer** system, the sewer becomes overloaded and capacity is exceeded, leading to **SSOs** and **BBs**. To prevent this from occurring, the **District** is implementing an Infiltration/Inflow Control Program with which all **satellite entities** must comply. The effective date of the Infiltration/Inflow Control Program described in §801 through §806 is July 10, 2014.

Infiltration

Infiltration removal/reduction addresses **groundwater** entering defective sewer systems. Sewer system defects that allow infiltration include pipe cracks, open/offset joints, open connections, etc. Removal/reduction of infiltration sources is generally accomplished by rehabilitation (repair/replacement) of the sewer system. Additional advantages to rehabilitation include restoring the structural integrity of the system, increased hydraulic capacity and the prevention of tree root intrusion.

Inflow

Inflow removal/reduction addresses **stormwater** and **groundwater** conveyance systems that are connected to the **sanitary sewer** system. Conveyance systems that contribute clear water inflow into the **sanitary sewer** system include downspouts, foundation/footing drains, sump pumps, area drains, etc. Removal/reduction of inflow sources is generally accomplished by disconnection from the **sanitary sewer** and rerouting of discharge into a **stormwater** conveyance system or redirecting discharge flows at grade. Figure 8.1 illustrates the most common sources of clear water into the **sanitary sewer** system. Figure 8.2 is a graphical representation of the components of wet weather flow in a sanitary sewer.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

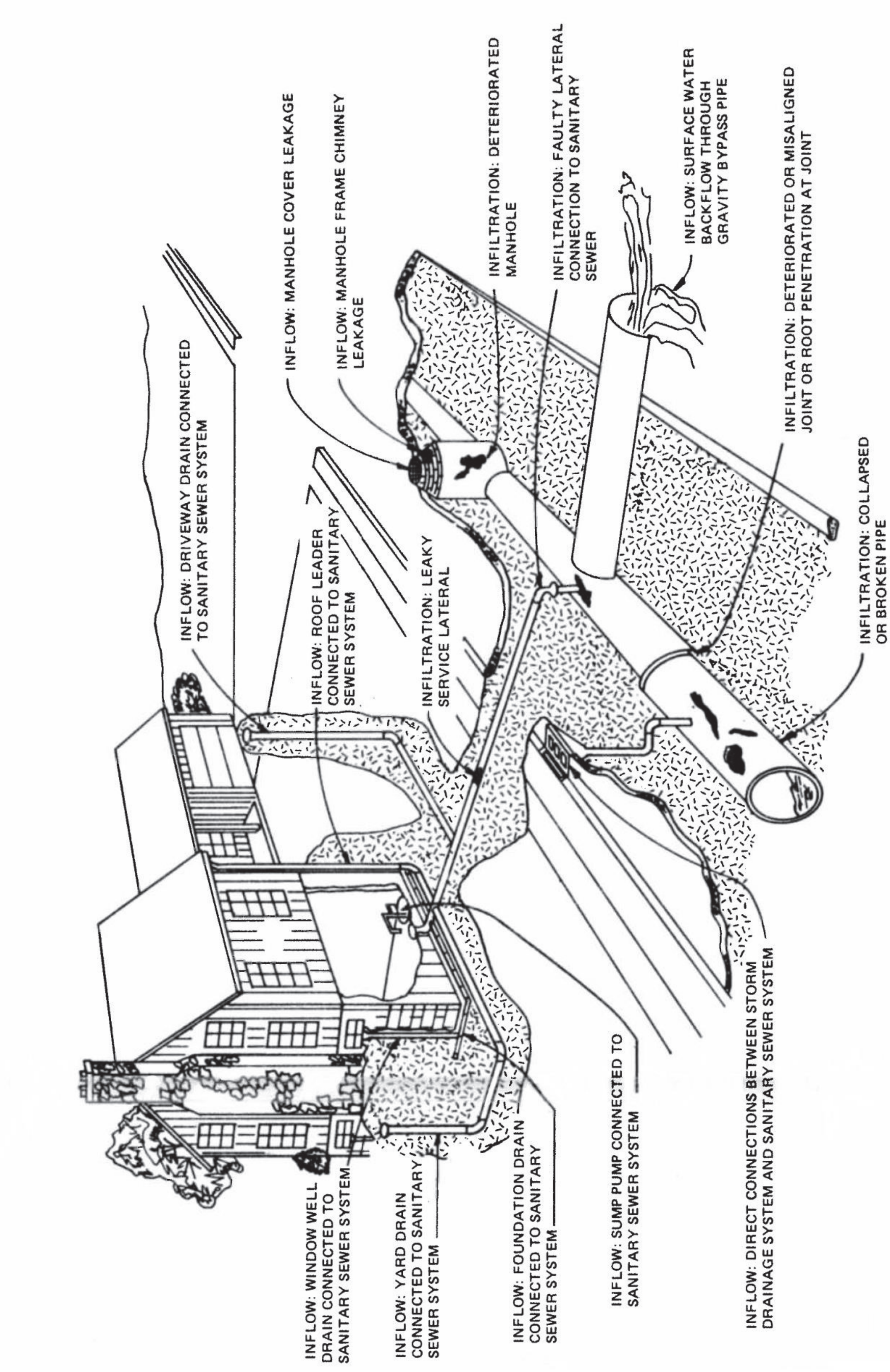


Figure 8.1. Typical Sources of Infiltration and Inflow

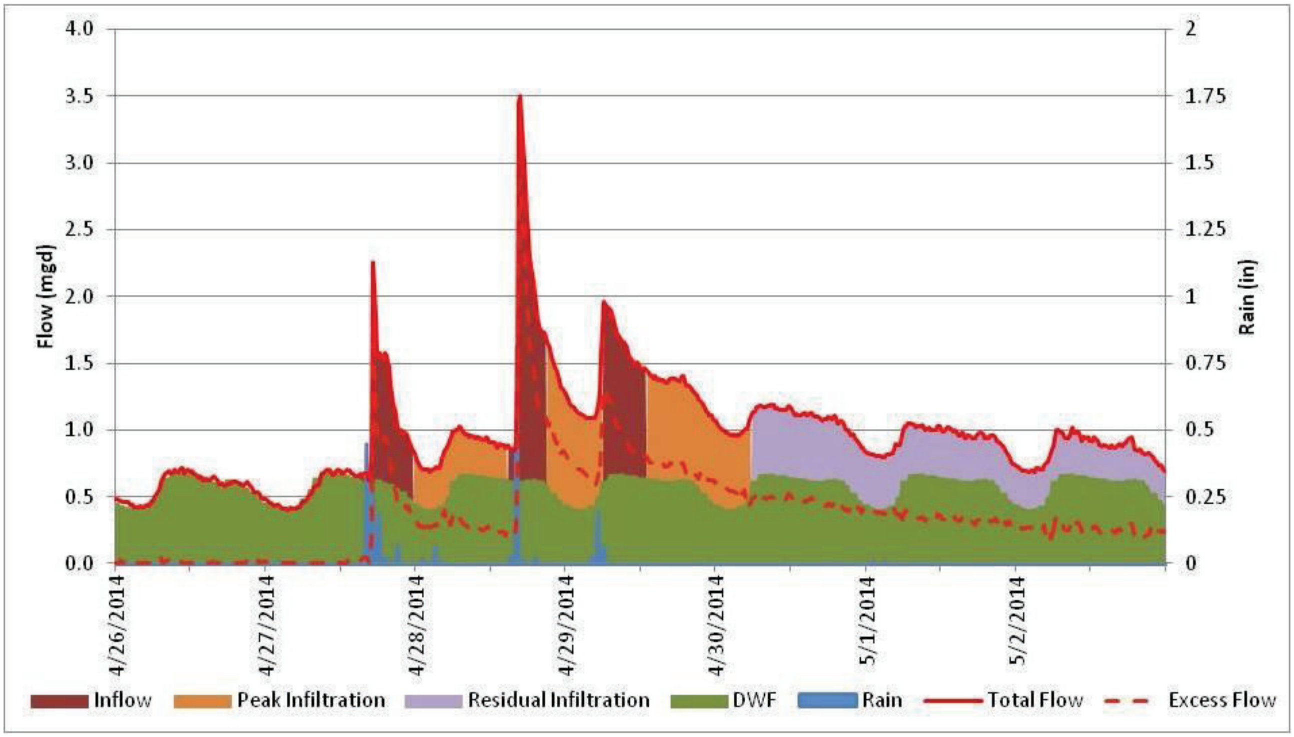


Figure 8.2.Typical Components of Rainfall-Derived Inflow and Infiltration

History of Infiltration and Inflow Control Programs at the District

The **District** serves both **combined sewer areas** and **separate sewer areas**. Permits issued by the **District** allowing local sewer system owners to connect to **District** interceptors dating back to 1920 contain language prohibiting surface water from entering the **sanitary sewer** system. Although such language was included in the **District's** permits issued in **separate sewer areas** since that time, excessive I/I in the **District's** system became a growing problem. The Federal Water Pollution Control Act, as amended on October 18, 1972 by Public Law 92-500, required all applicants for treatment works grants from **USEPA**, after July 1, 1973, to demonstrate that each sewer system discharging into such treatment works is not subject to excessive infiltration/inflow. This requirement motivated the **District** to amend the **Manual of Procedures** for the Administration of the **Sewer Permit Ordinance** (MOP) in 1972 to include Article 6.5, which became effective January 1, 1973. Article 6.5 contained the **District's** I/I control program which included the following requirements:

- Within one year of the effective date, all **satellite entities** had to inspect all structures for directly and indirectly connected downspouts, and have all such downspouts properly disconnected from the **sanitary sewer** system.
- Within one year of the effective date, all **satellite entities** had to inspect their public systems for inflow sources and remove such sources.
- All **satellite entities** were to submit quarterly progress reports.

Initially, the **District** required **satellite entities** to demonstrate that average daily wet weather flow in the **sanitary sewer** system did not exceed 100 gallons per capita per day. In the 1970s, at the request of satellite system owners, the **District** raised the maximum allowable wet weather flow rate to 150 gallons per capita per day. Areas that were served by **combined sewer** systems were exempt from this program because excessive wet weather flows would, in theory, be captured by the **Tunnel and Reservoir Plan (TARP)**.

Many **satellite entities** took advantage of grant money offered by **IEPA** to hire consultants to prepare Sewer Systems Evaluation Studies (SSES). An SSES was necessary to receive grant funds for sewer rehabilitation. Once a scope of work was defined as a result of an SSES, a satellite system owner would hire contractors to perform required rehabilitation work on the public sector sewer system. One condition of receiving these grants was that sewer system owners agreed to adequately maintain their sewer system going forward.

Despite the easing of requirements under the initial I/I control program, most **satellite entities** found the compliance criteria too difficult and costly to achieve and appealed to the **District Board of Commissioners** to consider a program that emphasized the cost effectiveness of reducing I/I instead of having an absolute goal. In 1985, a series of meetings were held between elected local officials and representatives of the **District**, **IEPA** and **USEPA** on the matter of **sanitary sewer** rehabilitation. This led to the **Sewer Summit Agreement** (**SSA**) which established guidelines and a schedule for achieving final compliance with **sanitary sewer** rehabilitation requirements that were acceptable to all of the involved parties. The **Board of Commissioners** adopted the **SSA** on November 21, 1985 and Article 6.5 of the **MOP** was amended to reflect the new Infiltration/Inflow Corrective Action Program (ICAP) option, in addition to the existing compliance criteria, which was referred to as the 150 gallons per capital per day (gpcpd) option.

Under the ICAP option, satellite system owners had to perform an evaluation of their system, and an SSES, which included a cost-effectiveness analysis of specific I/I removal measures. The cost of I/I removal was compared to the cost to transport and treat excess flow, if the I/I was not removed. The SSES also calculated a projected post-rehabilitation wet weather flow rate, following implementation of cost-effective I/I removal measures. Satellite systems were required to implement these measures and then perform post-rehabilitation flow metering to demonstrate the reduction in I/I. Satellite systems were also required to develop a **Long Term O&M Program (LTOMP)** addressing both the public and private sectors. Finally, satellite systems were required to submit annual summary reports after achieving compliance with ICAP.

The **District** was obligated to conduct analyses of each basin to assess the impact of the wet weather flow expected to remain in the system after satellite systems performed the required cost effective I/I removal work. In order to handle the review of the SSES from all satellites, review programs initiated by the satellites, and review certificates of compliance, the **District** contracted with Donohue and Associates and with Metcalf and Eddy to provide an extension to in-house staff. Donohue conducted the basin analyses and Metcalf and Eddy developed the <u>Operations and</u>

Maintenance Manual for Separate Sanitary Sewer Collection Systems for Local Agencies Tributary to the Metropolitan Sanitary District of Greater Chicago ("1989 Manual").

Despite the considerable effort and resources spent towards removing I/I under ICAP and the 150 gpcpd, the **District** still experiences high flows during wet weather from **separate sewer areas**. This is particularly evident at the **District's** treatment plants that serve only separate sewer systems (Hanover Park Water Reclamation Plant (WRP) and Egan WRP) and at the Lemont WRP, that serves a predominantly separate sewer system. In addition, the **District** is at risk of enforcement measures by regulators should **SSOs** occur within its system. Furthermore, satellite system owners have voiced concerns about evidence of excessive wet weather flow in the form of **SSOs** and **BBs** within their own systems.

The **IEPA** issued draft versions of **NPDES** operating permits for the **District's** Calumet WRP, North Side WRP and Stickney WRP in 2009 for public comment. These draft permits contained a new Special Condition addressing the **District's** I/I control program. The Special Condition stated:

> "In the event that local sewer system owners have excessive I/I (any wet weather flows exceeding 150 gpcpd 24-hour average with peak flow not to exceed 100 gpcpd times an allowable peaking factor in accordance with the Illinois Recommended Standards for Sewage Treatment Works) in their separate sewer systems that cause or contribute to basement back-ups and/or sanitary sewer overflows, the Permittee shall require that the local sewer system owner implement measures in addition to those required under the Sewer Summit Agreement in an effort to reduce the excessive I/I. Such additional remedies may include sewer system evaluation studies, sewer rehabilitation or replacement, inflow source removal, and restrictions on the issuance of additional sewer connection permits. A summary of such additional measures shall be included with the Sewer Summit Agreement Report."

This language allowed the **District** to require additional effort on the part of satellite system owners to reduce I/I under certain circumstances. Although the **IEPA** did not issue the **NPDES** permits containing this Special Condition until 2013, the **District** formed an Advisory Technical Panel (ATP) in 2011 to discuss elements of a new I/I control program. The ATP is comprised of representatives from the **USEPA**, **IEPA**, **municipalities**, sanitary districts, townships, a utility company, a sewer construction contractor, consultants, and **District** staff. The ATP met regularly throughout 2011, 2012 and 2013, and has provided insight and valuable perspective on elements of a new I/I control program proposed by the **District**. On July 10, 2014, the **District** adopted a new I/I control program, which is described below. The ATP's comments will be sought on the development of technical guidance on this program, and any future modifications of the program will be presented to the ATP.

SCOPE AND GOALS (§801)

The purpose of this program is to reduce **SSOs** and **BBs**, comply with the **District's NPDES** permit requirements and to eliminate extraneous flows to the **District's** facilities by the formation and adoption of an I/I Control Program (IICP). The IICP will require **satellite entities** to identify and address I/I sources within the public and private sewer system. This will be accomplished by the individual **satellite entities** developing and continually implementing their own **Long Term O&M**

Program (**LTOMP**) and **Private Sector Program** (**PSP**). Satellite system owners are in the best position to know what actions need to be taken to eliminate **SSOs**, **BBs**, and excessive wet weather flow. Therefore, latitude is offered under this program to satellite system owners to determine those actions that will effectively reduce excessive I/I. Further information regarding these programs is provided in §803, §804, and §805.

APPLICABILITY (§802)

The IICP applies to all **satellite entities** that are located within the **separate sewer area** (areas with separate sewers designed for wastewater and **stormwater**) that are directly and/or indirectly tributary to the District's facilities. The IICP also applies to the portions of local sewer systems located in the designated **separate sewer area**, when a local sewer system consists of both combined and separate systems. Separate sewer systems within the City of Chicago are exempt from the IICP.

GENERAL REQUIREMENTS (§803)

The IICP will be implemented by all **satellite entities** to reduce **SSO**s and **BBs**, and to reduce excess wet weather flow in the **sanitary sewer system**. This will be accomplished through Short Term Requirements, a **Private Sector Program (PSP)** and a **Long Term O&M Program**, and annual reporting of activities planned and performed to meet these requirements.

SHORT TERM REQUIREMENTS (§804)

Within the first five years of the effective date of the IICP, all **satellite entities** must complete the Short Term Requirements detailed herein. All **satellite entities** must conduct a condition assessment of their sewer system, undertake rehabilitation work to address I/I sources, and develop and submit their individual **LTOMP** and **PSP** to the **District** for approval.

Sewer System Condition Assessment

<u>Condition Assessment Prioritization</u>

The undertaking of the sewer system condition assessment is the first step in identification of I/I sources that lead to **SSOs** and **BBs**. At a minimum, the condition assessment must include all of the high risk public **sanitary sewers**. Satellite system owners shall determine the extent of high risk public **sanitary sewers** within their systems. This determination must be completed by the time the first Short Term Requirements Annual Report (described below) is submitted to the **District**, as it defines the scope of condition assessment activities for the first five years of the IICP.

Public sewers in the following areas may be considered high risk **sanitary sewers**:

A. Areas with **SSOs** and/or **BBs**;
B. Areas upstream of **SSOs** and **BBs**;
C. Subbasins known to surcharge;
D. Areas with excessive wet weather flows and/or excessive lift station pumpage; and
E. Areas with system deficiencies that could result in system failure.

Areas with SSOs and/or BBs are subbasins within a **sanitary sewer** system that have experienced one or more **SSO**s and/or **BBs** that have not been attributed to problems with the private **sanitary sewer** (such as a clogged private lateral), and that have not been resolved through rehabilitation or **maintenance** activities on the public sewer (such as sewer cleaning, sewer lining, point repairs, private sector improvements, etc.). Areas with more widespread and frequent **BBs** and **SSOs** should be addressed with a higher priority than areas with fewer **BBs** and **SSOs**.

Areas upstream of SSOs and BBs are subbasins that discharge into a public sewer upstream of the point where a subbasin with **SSO**s and **BB**s, as defined above, discharge into a public sewer. In Figure 8.2, if Subbasin 2 experiences **SSO**s and/or **BB**s, Subbasin 1 is considered an area upstream of an area with **SSOs** and **BBs**, since it discharges into the same **sanitary sewer** main line further upstream, and could contribute to **SSOs** and **BBs** in Subbasin 2.

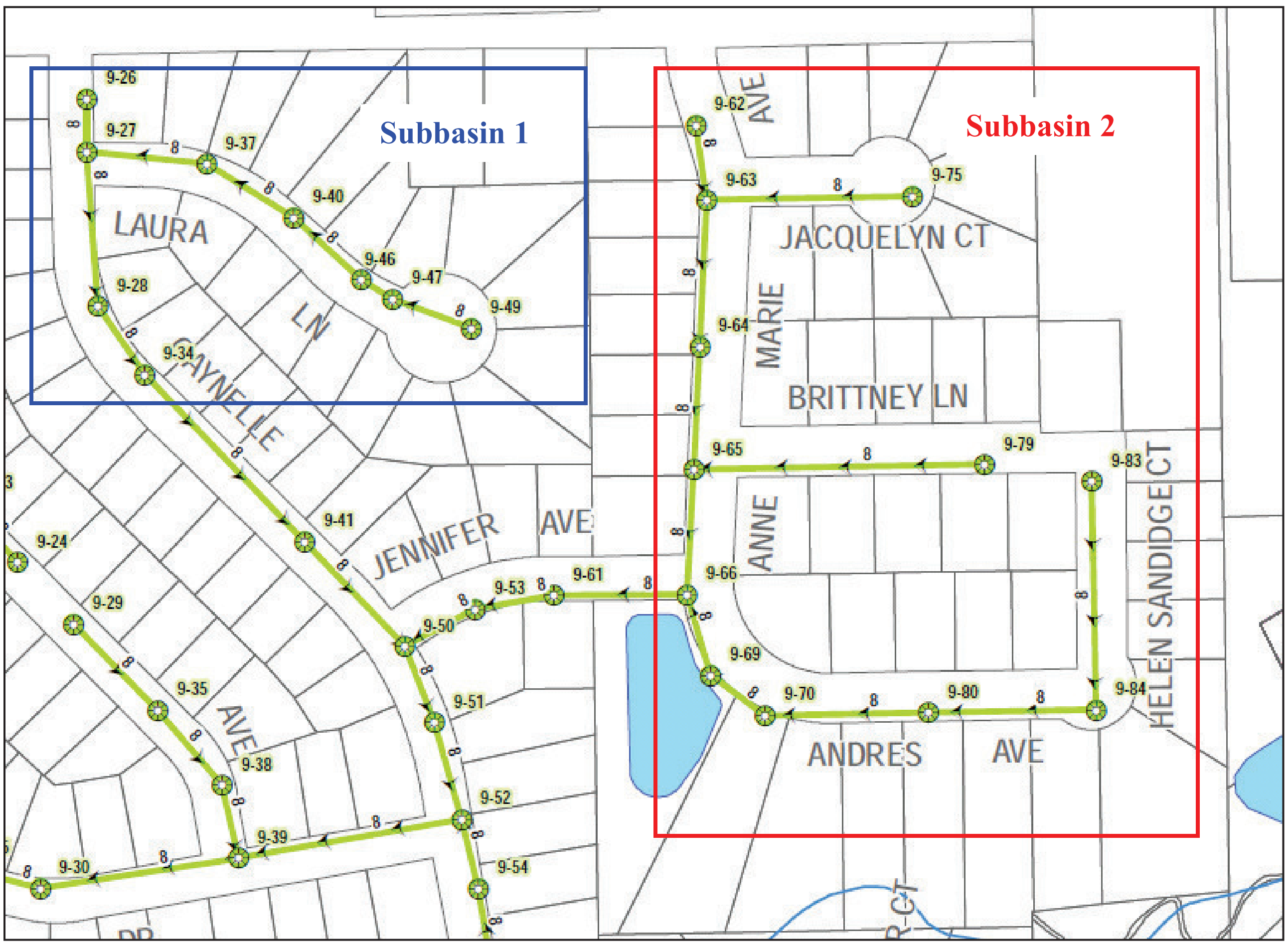


Figure 8.3. Subbasins Tributary to the Same Sanitary Main Line (Courtesy of the Village of Tinley Park)

Subbasins known to surcharge include areas where the satellite sewer system owner has knowledge of incidences of the hydraulic grade line in **sanitary sewers** exceeding the elevation of the crown of the sewers on an annual or more frequent basis. Such conditions would be ascertained through **sanitary sewer** flow metering, level measurement in manholes, and/or observations of **SSOs** and **BBs**. Although new flow metering is not required as part of this program, satellite system owners that have previously conducted flow metering may use the information collected to identify areas known to surcharge. If satellite system owners wish to conduct flow metering under the IICP to determine the severity and extent of surcharging in their systems, they are encouraged, but not obligated, to do so.

Areas with excessive wet weather flows include areas experiencing **SSOs**, **BBs** and/or surcharging as described above, but also include areas where flow metering has identified wet weather flows with peaking factors of 4 or greater, in the absence of other indicators of excessive wet weather flow. A peaking factor is the maximum wet weather flow rate at a particular location in the **sanitary sewer** divided by the dry weather flow rate at that same location. A description of how to conduct flow metering and determine peaking factors is provided in §805 of this document. Areas with larger peaking factors should be addressed with a higher priority than areas with lower peaking factors. As stated above, flow metering is not required under the IICP, but satellite system owners are encouraged to use reliable flow metering data obtained previously, or to conduct new flow metering - at their sole discretion - to determine wet weather peaking factors in their system.

Areas with excessive lift station pumpage include areas tributary to a sanitary lift station where the discharge flow rate from the lift station exceeds the rated capacity of the lift station, on occasion during wet weather. Sanitary lift stations are sized to accommodate dry weather flow. Although lift stations are designed to have redundant pumps, simultaneous operation of redundant pumps during wet weather to prevent or minimize a rising water level in the wet well is an indication of excessive I/I within the **tributary area**. Lift stations that have force main discharge pressure meters can be used to quantify peaking factors according to the method described in §805. Lift stations that only have event recorders, and no discharge pressure meters, cannot be used to quantify peaking factors.

Areas with system deficiencies that could result in system failure include areas with structural and/or operation and **maintenance** defects that allow significant I/I into the system or indicate high likelihood of sewer collapse or blockage that may lead to **SSOs** and/or **BBs**. Portions of the **sanitary sewer** system with defect grades of 4 or 5 according to the National Association of Sewer Service Companies (NASSCO) pipeline assessment guidelines are examples of such areas. Additional information about the NASSCO condition assessment guidelines is provided below.

Satellite system owners may use additional criteria to determine which portions of the public **sanitary sewer** system are considered "high risk." Any additional criteria must be described on the *Condition Assessment Prioritization Form* to be attached to the *Short Term Requirements Annual Summary Report Form* that is submitted to the **District**. Satellite system owners must explain the criteria they use to define high risk sewers within each of the aforementioned types of areas. If a satellite system does not include one of the aforementioned types of areas, then this must be indicated on the *Condition Assessment Prioritization Form* and a reason provided. Although portions of the sewer system may be grouped into more than one type of area, these portions must be listed under only one type of area shown on the form. For example, areas with **SSOs** and

BBs are also subject to surcharging, but such areas should only be listed in one row of the table. In no case shall less than ten percent (10%) of the **sanitary sewer** system be assessed over the five-year period preceding the effective date of the **LTOMP**. Figure 8.4 is an excerpt of a section of the *Condition Assessment Prioritization Form*, filled out as an example showing how a satellite sewer owner might prioritize the high risk **sanitary sewers** within the system. A map showing which sewers are high risk and the extent of the areas served by those sewers must be attached to the *Condition Assessment Prioritization Form*. This map should also show the full extent of the satellite system's service area. This map should be updated to show which areas have been inspected in the reporting year, and should be attached to each Short Term Requirements Annual Summary Report. Maps attached to subsequent submittals of the Short Term Requirements Annual Summary Report should identify areas that have been inspected in previous years since the effective date of the IICP as well.

Type of Area	Present In System (yes/no)	Prioritization Criteria	Linear Feet of High Priority Sanitary sewer to be Assessed in Short Term
Areas with SSOs and/or BBs	Yes	High risk areas have had SSOs and/or BBs reported during 1-year rain events and/or dry weather.	50,000
Areas upstream of SSO/BB areas	Yes	Not high risk. All have been lined in last 15 years. All manholes have been inspected and those allowing I/I have been rehabilitated in last 15 years.	0
Subbasins known to surcharge	Yes	High risk areas have surcharged in 1-year rain event.	50,000[(1)]
Areas with excessive wet weather flows, other than those listed above	No	Same as areas with SSOs and BBs. No flow metering has been performed to identify other areas with excessive wet weather flows.	0
Areas with excessive lift station pumpage	Yes	Not high risk. Public sewer in area tributary to pump station has been lined over past 10 years. Excessive lift station flows due to private sector I/I.	0
Areas with deficiencies that could result in system failures	Yes	H_2S corrosion evident in 15" main along Cambridge Street between First Ave. and Eighth Ave. This is high priority.	4,400
Other	Yes	Odor complaints submitted every week in dry weather along Gardner Street.	2,000
		Total length of public sanitary sewers (feet):	1,000,000
		Total length of High Priority sanitary sewer to be assessed in short term (feet):	106,400
		Percentage of public sanitary sewer system to be assessed in short term:	10.64%

[(1)]This total excludes areas with SSOs and BBs listed in the first row.

Figure 8.4. Sample Section from Condition Assessment Prioritization Form

Credit may be given for condition assessment of high risk sewers that has been completed within the five-year period preceding the effective date of the IICP. Should a satellite system have performed such assessments within the preceding five years, they must provide documentation that the work was completed and that NASSCO coding standards were used to code the defects. A report of such assessments in the NASSCO standard format, indicating the date of the televising, manhole inspection, smoke testing or dyed water testing, date of the assessment, name and certificate number of the person performing the assessment, and the individual findings, is acceptable documentation. To obtain credit for the previous work, submit the documentation to the **District** with the Short Term Requirements Annual Summary Report. If a **satellite entity** has completed rehabilitation work to address deficiencies identified during these pre-IICP assessments, that work shall be indicated on the Short Term Requirements Annual Summary Report. A sample of a completed Short Term Requirements Annual Summary Report is included in Appendix D.

If a **satellite entity** has inspected and performed rehabilitation through CIPP lining of a high risk public **sanitary sewer** and associated manholes more than five years before the effective date of the IICP, but still considers the sewer to be high risk, the **satellite entity** may request a waiver from the requirement to televise the rehabilitated public sewer and inspect manholes in this high risk area. Smoke testing of the public sewers and follow-up dyed water testing and external property inspections as described below will still be required in areas served by the rehabilitated high risk **sanitary sewers**. Furthermore, the **satellite entity** will need to televise an equivalent length of public sewers that have not been rehabilitated, but may be sources of significant I/I, and perform inspections of the associated manholes, as part of the Short Term Requirements. This waiver must be requested in a letter submitted to the **District** with the completed *Condition Assessment Prioritization Form*. The map submitted with the *Condition Assessment Prioritization Form* must clearly indicate the location of the:

- Rehabilitated high risk sewers that will be smoke tested and dyed water tested;
- The areas tributary to these rehabilitated high risk sewers;
- Unrehabilitated high risk sewers to be televised/inspected, smoke tested and dyed water tested; and
- Unrehabilitated non-high risk sewers to be televised/inspected only.

The waiver request letter must state when the rehabilitation work was performed and the method of rehabilitation used.

Once the **District** approves the waiver request and proposed plan for condition assessment, the **satellite entity** should report its progress on the Short Term Requirements Annual Summary Report and Status of High Priority Deficiencies forms, as described later in this chapter.

As indicated above, the definition of high risk public sewers shall be completed by the time the first Short Term Requirements Annual Summary Report is submitted to the **District**. Revisions to the definition of high risk public sewers can be made, if, for example, wet weather events that occur after the first year indicate that additional areas are susceptible to **SSO**s and **BB**s. Such revisions will be considered by the **District** on a case by case basis. Declassification of an area as high risk due to a lack of rain and subsequent reduction in **SSO**s and **BB**s will not be allowed. Any revisions to the definition of high risk public sewers must be described in a narrative attached to the Short Term Requirements Annual Summary Report.

Condition Assessment

Once the high risk sewers have been identified, each satellite system owner must conduct a condition assessment of the elements of the **sanitary sewer** system within the high risk areas. Assessment of all high risk sewers must be completed within five years of the effective date of the IICP. All condition assessment work shall be reported to the **District** on the *Short Term Requirements Annual Summary Report Form*.

At a minimum, condition assessment under the Short Term Requirements of the IICP shall consist of:

- Televising all high risk public sewer lines;
- Inspection of all manholes in high risk areas;
- Inspection of all lift stations in high risk areas;
- Smoke testing all high risk public sewer lines;
- Conducting dyed water testing in high risk areas where:
    - **Storm sewer**s or storm ditches run parallel to or cross the **sanitary sewer**s and service laterals and are located above the **sanitary sewer** system and where prior smoke testing has indicated the possible location of a cross-connection;
    - Streams, drainage ditches and areas subject to ponding are located above the **sanitary sewer** system and where prior smoke testing has indicated the possible location of a cross-connection, downspouts are discharged below ground and may be connected to the **sanitary sewer** system, and smoke testing could not confirm or rule out such a connection; and
- Conducting follow-up external property inspections in high risk areas that have previously been smoke tested to determine whether downspouts that discharge below ground but that did not smoke are connected to the **sanitary sewer** and to determine the exact condition of cleanouts that did smoke.

Inspections of the public **sanitary sewer** system must be conducted in accordance the NASSCO standards for Pipeline Assessment and Certification Program (PACP®), Manhole Assessment and Certification Program (MACP®), and Lateral Assessment and Certification Program (LACP®) (where applicable). Smoke testing shall also be conducted in accordance with NASSCO standards. A description of methods for conducting condition assessments and related guidance is provided below.

If a satellite system owner has an inspection program already in place on the effective date of the IICP that does not adhere to NASSCO standards, and the satellite system owner believes his or her program accomplishes substantially similar goals as the NASSCO standards, the satellite system owner may request that the **District** allow his or her existing inspection program to continue to be used instead of a NASSCO program. This request must be submitted to the **District** by the time the first Short Term Requirements Annual Report (described below) is submitted to the **District**. Such a request must include a narrative description of the existing program, written standards for inspection of facilities and classification of defects by severity including whether they are high risk defects, a description of training requirements for staff conducting the inspections, and inspection forms. If the **District** concurs that the existing inspection program is substantially similar to NASSCO's programs and that classification of defects occurs according to standards, then the satellite system will be allowed to continue using its system.

Background on Condition Assessment Methods

Standardization of the condition inspection and assessment procedures under the IICP will provide for the following:

- Uniform inspection standards based on current technology coupled with uniform classification of main sewer, and manhole defects under the NASSCO coding system will provide for uniform reporting, and assessment of compliance with **District** requirements for all of the **satellite entities**.
- Consistency in the development of Short Term Requirements rehabilitation costs by satellite system owners.
- Equitability among **satellite entities** and credit for those that have already conducted investigation/rehabilitation work.
- Standardization of rehabilitation work eligible for **IEPA** SRF funding, and possible **District** funding.
- Consistency in annual reporting to **District** of completed rehabilitation.

Condition inspection standards for **satellite entities** were first established in 1989 as part of the **District** ICAP program (See 1989 Manual). Since the publication of this manual, new condition inspection technologies and national standards for classification and coding of I/I defects have been developed and refined. NASSCO has developed a standard **sanitary sewer** defect identification and numerical coding system for **sanitary sewers**, manholes and service laterals. This coding system has been in place since 2001, and is supported by a network of certified trainers. NASSCO coding standards are now a common requirement of **USEPA**/Department of Justice Consent Decrees.

Closed Circuit Television Inspection (CCTV)

Television inspection involves pulling a television camera through a sewer while an operator observes recorded footage on a computer monitor via closed circuit television signals. Figure 8.5 shows examples of defects in sewers identified by CCTV inspection. Basic procedures for conducting CCTV are addressed in the 1989 Manual on pages 4-7 to 4-11. In addition to procedures addressed in this manual, television inspection must meet the requirements of NASSCO PACP® (Pipeline Assessment and Certification Program - Current Version). Sewer inspection by CCTV will permanently document the condition of the sewer. The video can then be reviewed and the sewer assessed by NASSCO defect coding.

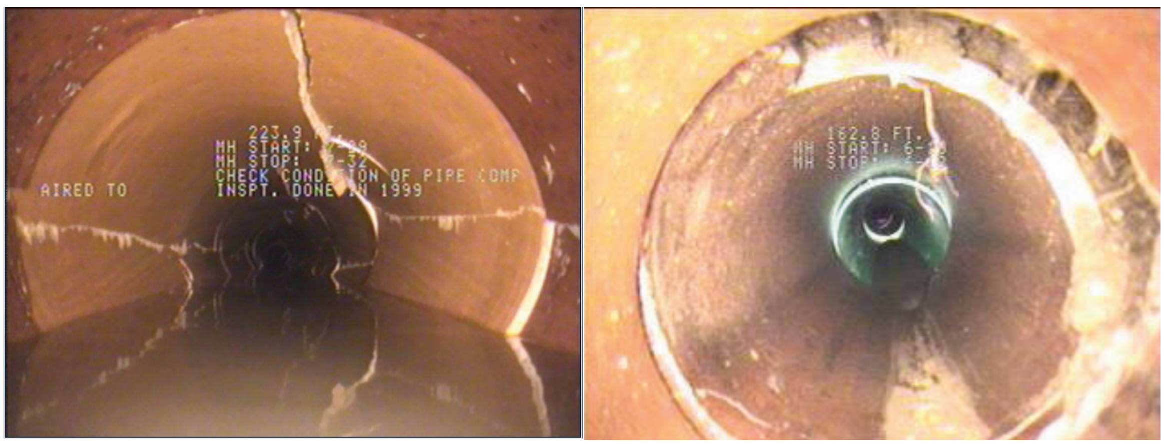


Figure 8.5. High-Priority Mainline Pipe Defects - Left: Multiple Fracture; Right: Hole

Television inspections should also include the following procedures:

- Operators performing CCTV and software shall have current certification by NASSCO for PACP®.
- Cameras shall be color with pan and tilt capability and capable of turning at right angles to pipe's axis (minimum pan of 270 degrees and minimum rotation of 360 degrees). Cameras may also be equipped with digital sidewall scanning capability.
- Sewer condition shall be reviewed at no greater than 30 feet per minute while stopping at all lateral connections and mainline defects.

Satellite entities are encouraged to utilize GIS technology as a part of the **LTOMP**. Data collected from televising inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. Defects and attributes shall be measurable from either the upstream or downstream manhole. Digital audio, video and photographs should be linked in the database to the pipe segments inspected.

Manhole Inspection

Basic procedures for conducting manhole inspections are addressed in the 1989 Manual on pages 4-3 to 4-7. Manhole components and typical clear water entry points are illustrated in Figure 8.6.

Examples of manhole defects identified during inspections are shown in Figure 8.7. As stated above, in addition to procedures addressed in the 1989 Manual, manhole inspections must comply with the current version of NASSCO's MACP®, and should include the following procedures:

- Full descent inspections
  Manhole conditions including manholes greater than twelve feet deep, manholes with significant debris, manholes with structural conditions that may require immediate rehabilitation, or manholes where accurate rim to invert elevations are required for system modeling should be inspected by full descent procedures.
- "Pole camera" (remote)inspections
  Manhole conditions including manholes greater than twelve feet deep, manholes with significant debris, or manholes with structural conditions that may require immediate rehabilitation, could also be inspected by "pole camera" procedures.
- Surface Inspections
  Manholes with none of the above conditions could be inspected by either surface inspection, full descent or "pole camera" procedures. Surface inspections can be effective for identifying defects and manhole conditions in the top portions of the manhole. Surface inspections should be performed in accordance with NASSCO Level 1 Manhole Inspection procedures.

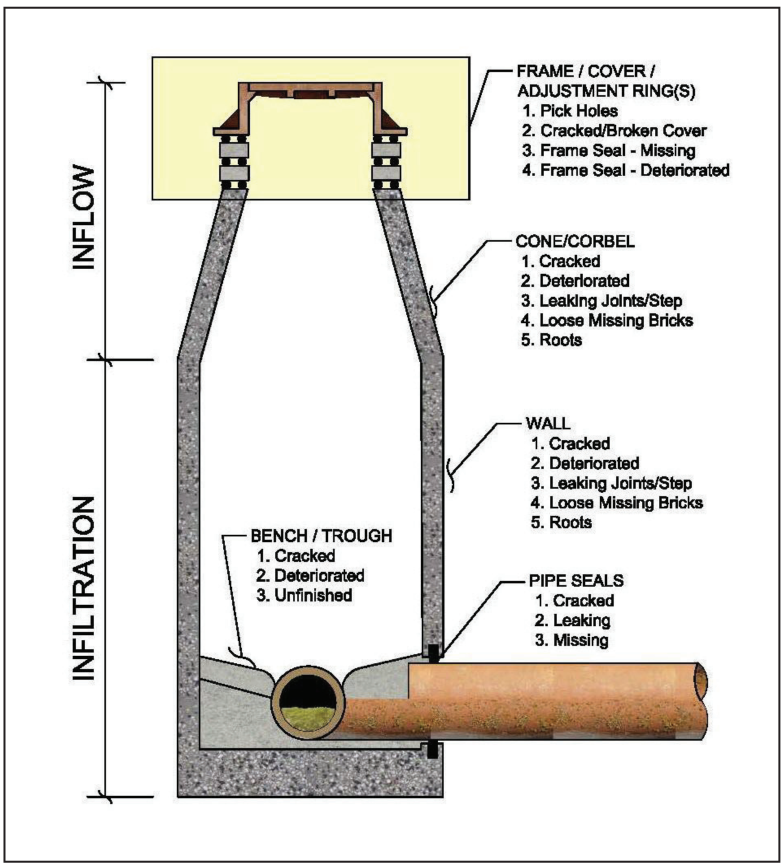


Figure 8.6. Components of a Manhole with Correlate Defects

Manhole inspections should be documented by video and/or photographs. This method will permanently document the condition of the manhole. The video and/or photographs can then reviewed and the manhole assessed using MACP® defect coding.

Figure 8.7. High-Priority Manhole Defects – Left: Deteriorating Brickwork; Right: Deteriorated Adjustment Ring

Data collected from manhole inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location for manholes shall be provided. Digital videos and photographs should be linked in the database to the manholes inspected.

Lift Station Inspection

Basic procedures for conducting lift station inspections are addressed in the 1989 Manual on Pages 4-11 to 4-18. Note that in case a **satellite entity** wishes to use a lift station as a flow monitoring point, the lift station should be calibrated first. This is performed using a force main pressure meter or by conducting a fill and draw calibration of the wet well, which includes timed calibration of the pump station discharge against wet well level. Data collected from lift station inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location and address linking, if applicable, for lift station locations shall be provided. Digital videos and photographs should be linked in the database to the inspection record.

Smoke Testing

Smoke testing is a relatively inexpensive way to identify inflow sources by introducing smoke into a sanitary manhole and observing points where smoke escapes to the atmosphere. Smoke testing is required under the Short Term IICP to identify downspouts that are illegally connected to the **sanitary sewer**, as well as direct and indirect cross-connections. Basic procedures for conducting smoke testing are addressed in the 1989 Manual on pages 4-31 to 4-35.

In addition to procedures addressed in the 1989 Manual, **sanitary sewer** smoke testing must be compliant with the NASSCO Performance Specification Guidelines for Sanitary Sewer Smoke

Testing - December, 2010 - including the use of NASSCO inspection header and defect codes. In the case of any conflict in procedures between the two standards, the NASSCO standard will govern. Due to the prevalence of clay soils and significant soil moisture typical in the Northeastern Illinois area, as well as the frequency of indirect cross-connections between **storm sewer**/storm ditches and the **sanitary sewer** system, smoke testing programs should include the following provisions:

- Smoke Blower Configuration
  In order to ensure that smoke is "driven" through soil seams and reaches the surface for identification of indirect cross-connections between **storm sewer**/storm ditches and the **sanitary sewer** as well as for the identification of main line and service lateral defects, dual smoke blowers must be used. One blower shall be placed at the upstream manhole and the other at the downstream manhole. It is not necessary to install blowers in adjacent manholes that are less than 400 linear feet apart. In such cases, one blower can be installed in the next manhole along the sewer. The dual blower configuration is shown in Figure 8.8.
- Identification of Suspect Sources
  As required in the NASSCO Performance Specification Guidelines for Sanitary Sewer Smoke Testing Section 3.03.A.4, suspect sources (sources that due to their nature may be connected to the **sanitary sewer**) should be recorded when vent stacks do not exhibit smoke. In addition, downspouts piped underground, driveway drains and area drains that are observed without any exiting smoke should be recorded for possible follow-up dye water testing, regardless of whether vent stacks did or did not exhibit smoke. Suspect sources like downspouts, area drains and driveway drains that are connected to the **sanitary sewer** may not exhibit smoke during smoke testing for one of two reasons:
  1. The main sewer that they are connected to has a blockage which limits smoke from getting to the source (ie. no vent smoke on homes), or
  2. The downspout, area drain or driveway drain itself is trapped or discharges to a clogged or partially blocked service lateral.

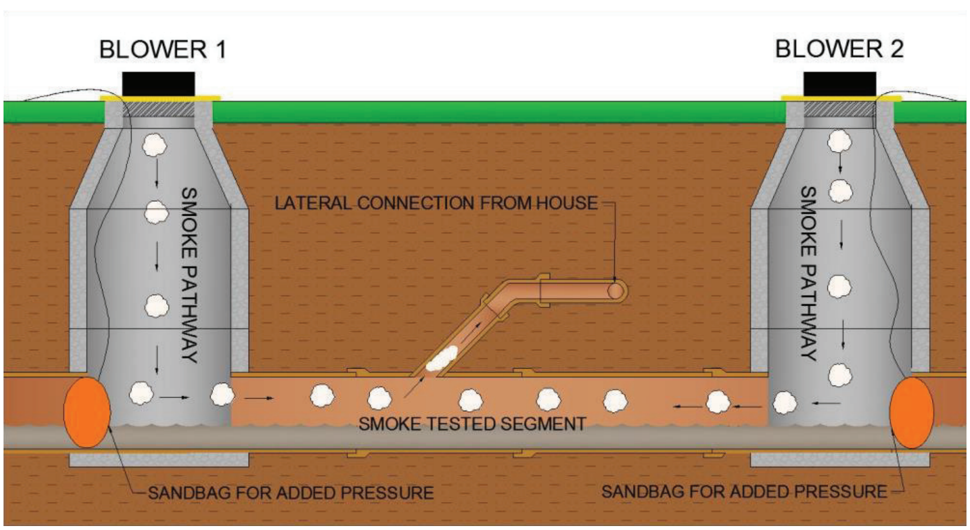


Figure 8.8. Dual-Blower Smoke Testing Process

Defect data collected from smoke testing should be delivered in a database format capable of integration into industry standard GIS systems. A mapping grade location for smoke observations shall be provided. Digital videos and photographs should be linked in the database to the smoke observations recorded.

Smoke testing will identify I/I sources on private property. The IICP requires disconnection of direct and indirect cross-connections within one year of identification. Other I/I sources will likely be identified during smoke testing, such as driveway drains, area drains, and window well drains. Although **satellite entities** are urged to take action to have such I/I sources disconnected promptly, the IICP requires that **satellite entities** keep records of the location and nature of such sources. The **satellite entities' PSP** will address whether and how such I/I sources are to be managed.

Dye Water Testing

Dye water testing will need to be performed at locations where smoke testing does not conclusively identify whether a potential inflow source is connected to the **sanitary sewer**, or where confirmation of a possible connection identified through smoke testing is needed. This method of testing is useful in confirming the presence of both direct inflow sources and indirect I/I sources. Dye water testing with plugging should be used for identifying cross-connections with **storm sewer**/storm ditches (with and without television inspection). Dye water testing without plugging should be used for confirming whether private sources (including downspouts piped underground, driveway drains and area drains) are connected to the **sanitary sewer**.

Basic procedures for conducting dye testing are addressed in 1989 Manual on pages 4-29 to 4-31. In addition to the provisions of the 1989 Manual, the typical nature of the I/I defects within the **District satellite entities** also requires that both depth of flow and velocity in the **sanitary sewer** should be measured before starting the dye water testing setup and again after dye transfers to the **sanitary sewer**. This allows for a quantification of the magnitude of peak flow from the cross-connection.

Under the IICP Short Term Requirements, direct and indirect cross-connections, directly connected downspouts, and broken or missing cleanout caps must be rectified. Dye water testing is an effective method for confirming these sources, if smoke testing alone does not. It is also effective at confirming other private sector I/I sources such as directly connected area drains, driveway drains and window well drains. While **satellite entities** are urged to identify and address as many of these I/I sources as possible during the Short Term Requirements, they are not obligated to do so until the **LTOMP** begins. Should such I/I sources be found during the Short Term Requirements, **satellite entities** must keep a record of the location and nature of the sources so that they can be addressed under the **PSP**.

Defect data collected from dyed water testing should be delivered in a database format capable of integration into industry standard GIS systems. A mapping grade location for defect observations shall be provided. Digital audio, videos, and photographs should be linked in the database to the defect observations recorded.

Property Inspection

Property inspections consist of entering onto private property and inspecting for any connections that contribute **stormwater** to the **sanitary sewer** collection system. Internal inspections involve entering the resident's home while external inspections involve checking the exterior parts of the **building** and yard(s). Typically, when inside the residence, inspectors are looking for storm or combination sump pumps discharging into the **sanitary sewer**, or a diverter setup where the homeowner can control the discharge location of the storm sump. The following are descriptions of the three common types of sump pumps and a diverter valve:

- **Sanitary Sump:** A sanitary sump collects sanitary wastewater from within a **building** and pumps it to the **sanitary sewer**.
- **Storm Sump:** A storm sump collects **groundwater** drainage from footing drains and routes it to a **storm sewer** or to the outside **building** yard. The correct configuration of storm and sanitary sumps and discharge piping is shown in Figure 8.9. Storm sumps that are improperly connected to the sanitary sewer, as shown in Figure 8.10, can be significant sources of inflow.

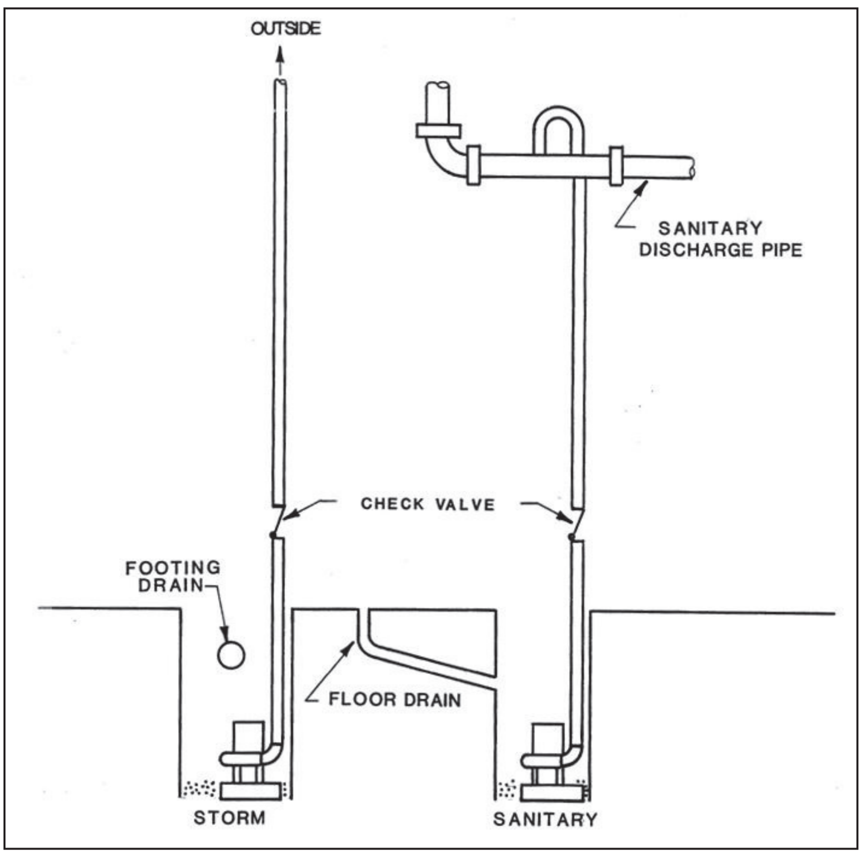


Figure 8.9. Separate Storm and Sanitary Sumps with Separate Discharge Piping (Compliant Condition)

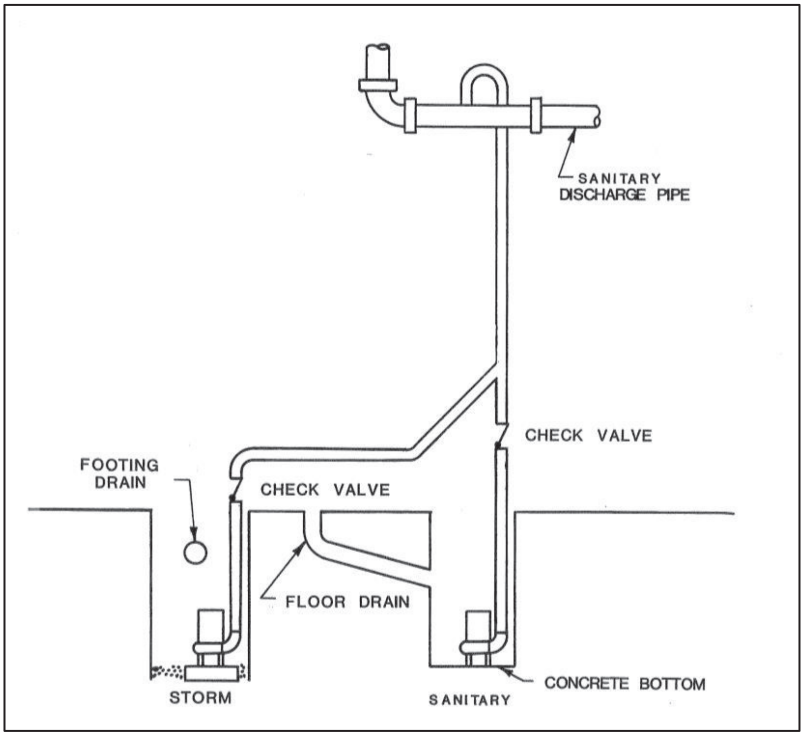


Figure 8.10. Storm Sump Connected to Sanitary Sewer

- **Combination Sump:** A combination sump collects both sanitary waste and **groundwater** drainage and is routed to the **sanitary sewer**. Figure 8.11 illustrates this configuration.

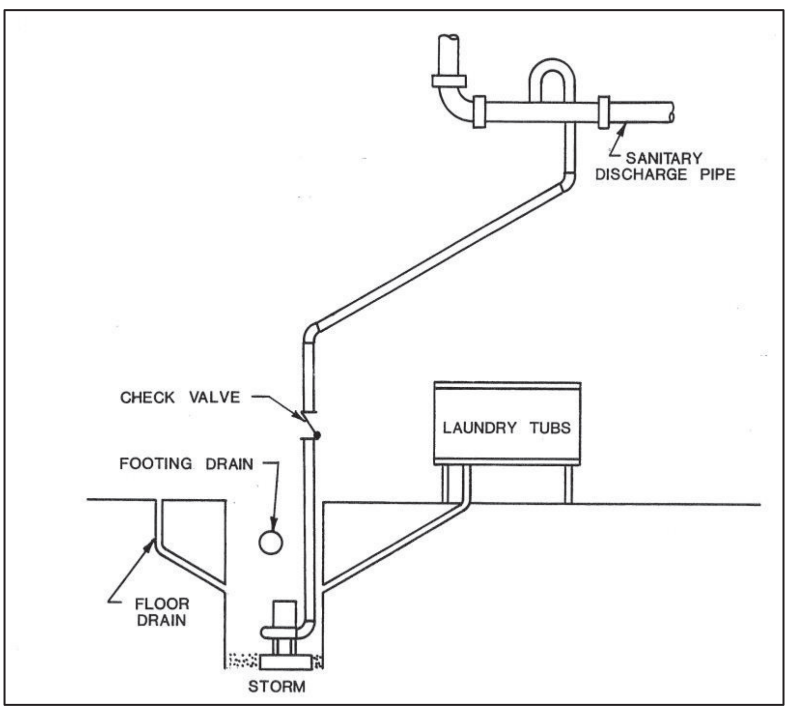


Figure 8.11. Combination Sump Pump

- **Diverter Valve:** A diverter valve is a valve on a storm sump that allows routing the storm sump discharge to either the **sanitary sewer** or to the outside yard. Figure 8.12 shows a storm pump installation using a diverter valve.

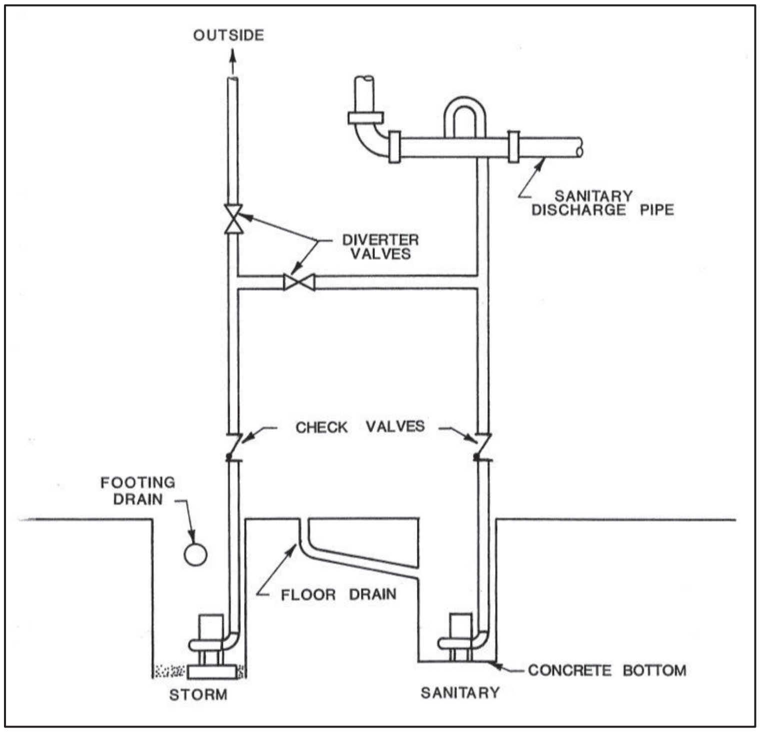


Figure 8.12. Storm Sump with Diverter Valve

Under the Short Term Requirements, **satellite entities** are not required to conduct internal **building** inspections. However, **satellite entities** may need to enter onto private property to conduct dye water testing where smoke testing does not conclusively identify whether a downspout discharging underground, or whether a cleanout with a damaged or missing cap does not release smoke during smoke testing. **Satellite entities** will also have to enter onto private properties to verify corrective work to address illegally connected downspouts and uncapped cleanouts, in order to fulfill the Short Term Requirements. Internal/external property inspections will be required as part of the **PSP** and **LTOMP**, as described later in this chapter. Basic procedures for conducting internal/external **building** inspections are addressed in the 1989 Manual on pages 4-21 to 4-23.

In addition to procedures in this manual, the **District** recommends that internal/external **building** inspection also include dye testing to determine whether storm sumps, combination pumps, and/or unsealed sumps discharge to the **sanitary sewer** or to some other location. This dye testing would be used only when the discharge location of the sump pump cannot be determined visually.

Data collected from private property inspections (attribute and defect) should be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, data collected shall be linked to an address and a mapping grade location. Digital videos and photographs should be linked in the database to the inspection record.

Additional Condition Assessment Methods

Additional condition assessment methods such as flow monitoring, electro scanning, and blockage detection using acoustic testing are described in §805. Although these techniques are not required by the **District**, **satellite entities** are encouraged to use them where appropriate to identify portions of the **sanitary sewer** system requiring more detailed inspection, **maintenance** and/or rehabilitation.

High Priority Deficiencies

The goals of conducting a condition assessment of high risk **sanitary sewers** under the Short Term Requirements are:

- To identify High Priority Deficiencies, and
- To identify rehabilitation needs which form the basis of a Capital Improvement Plan (CIP).

High Priority Deficiencies are defects that have a low cost of removal to I/I flow rate ratio or that have a high likelihood of causing sewer collapse or blockages if not rehabilitated. All High Priority Deficiencies must be addressed and corrected as quickly as possible. The **District** requires that direct and indirect cross-connections identified during a conditions assessment of the high risk sewers be disconnected within one year of identification. This includes downspouts that are directly connected to the **sanitary sewer** or poorly disconnected from the **sanitary sewer**. In some cases, downspouts that were disconnected by plugging of the downspout lead line at grade with hydraulic cement have deteriorated over time to allow roof water to re-enter the **sanitary sewer**. The **District** requires repair of missing or broken lateral cleanout caps within one year of identification. For those High Priority Deficiencies that cannot be immediately addressed, a CIP must be prepared to correct them. Work on High Priority Deficiencies in the CIP must begin within three years of identification of the High Priority Deficiencies.

In order to ensure uniformity in defect coding across all **satellite entities**, they must be in compliance with the NASSCO defect identification and l coding system for **sanitary sewers**, manholes and service laterals. . NASSCO's defect codes are assigned a grade from 1 to 5 using the PACP® Code Matrix (provided in NASSCO's Certification Program documentation) and in Appendix D. Grades are assigned based on the significance of the defect, extent of damage, percentage of flow capacity restriction or the amount of wall loss due to deterioration. Detects fall within one of two categories—either structural defects or O&M defects, with 5 indicating the most significant defects.

A High Priority Deficiency is defined as NASSCO condition Grade 4 or 5 and all illegal connections. However, for the purpose of the IICP, high-cost removal of illegal sources including driveway drains, foundation drains and window well drains can be addressed under a long term disconnection program that is part of a **satellite entity's PSP**.

High Priority Public Main Line Sanitary Sewer Defects

High Priority Deficiencies include structural and/or operation and **maintenance** defects that allow significant I/I and defects that could result in sewer collapse or blockage that may lead to dry and/or wet weather **SSOs** or **BBs**.

The following tables summarize current NASSCO defect coding and grading of High Priority Deficiencies in **sanitary sewers.** The current NASSCO Manual should always be referenced for the latest codes and grades:

Table 8-1. Structural High Priority Deficiency Grades

Structural	Grade
Crack Hinge	4-5 (depends on location)
Fracture Multiple	4
Fracture Hinge	4-5 (depends on location)
Broken	5
Collapse	5
Deformed	4-5 (depends on severity of deformation)
Hole	4-5
Surface Aggregate Missing	4
Reinforcement Visible	5
Reinforcement Corroded	5
Missing Wall	5
Brick Work Missing	4
Dropped Invert (brick)	5

Table 8-2. O&M High Priority Deficiency Grades

O&M	Grade
Deposits (all) 20-30%	4
Deposits (all) > 30%	5
Root Ball Barrel	5
Root Ball Lateral	4
Root Ball Connection	4
Infiltration Runner	4
Infiltration Gusher	5
Obstacles/Obstructions (all) 20-30%	4
Obstacles/Obstructions (all) > 30%	5

High Priority Manhole Defects

High Priority Manhole Defects include structural and/or O&M defects that allow significant I/I, in addition to defects that could result in manhole collapse or blockage that could lead to dry and/or wet weather **SSOs** or **BBs**. Manhole inspections are performed in accordance with the NASSCO Level 1 and Level 2 inspection criteria. Level 1 inspection is performed to evaluate the general condition of the structure and to determine if a Level 2 inspection is needed. A Level 2 inspection is to gather detailed information to fully document all existing defects.

The following tables summarize current NASSCO defect coding and grading of High Priority Manhole defects for Level 1 and Level 2 inspections. The current NASSCO Manual should always be referenced for the latest codes and grades:

Table 8-3. Level 1 Defect Codes (General Condition)

Level 1	Condition
Cover Type	Vented
Cover Condition	Cracked, Broken, or Missing
Frame Condition	Cracked, Broken, or Missing
Frame Offset Distance	> 3-inches
Frame Seal Inflow	IG, IR, or ID
Chimney I/I	IG, IR, or ID
Additional Component Information	Note significant structural or I/I observations

Table 8-4. Level 2 Defect Grades (Detailed Inspection - Structural)

Level 2 Structural	Grade
Fracture Multiple	4
Broken	5
Collapse	5
Deformed	4-5 (depends on severity of deformation)
Surface Aggregate Missing	4
Reinforcement Visible	5
Reinforcement Corroded	5
Missing Wall	5
Brick Work Missing	4

Table 8-5. Level 2 Defect Grades (Detailed Inspection - O&M)

Level 2 O&M	Grade
Root Ball Barrel	5
Root Ball Lateral	4
Root Ball Connection	4
Infiltration Runner	4
Infiltration Gusher	5
Obstacles/Obstructions (all) 20-30%	4
Obstacles/Obstructions (all) > 30%	5
Root Ball Barrel	5
Root Ball Lateral	4

High Priority Cross-Connections

Cross-connections between **sanitary sewers** and **storm sewer**s/storm ditches can be large contributors of I/I flows into a **sanitary sewer** system. Cross-connections are first identified during a smoke testing program. Smoke reaching the surface in a storm ditch or exiting a **storm sewer** inlet and/or manhole is typically followed by dye water flooding of the **storm sewer**/storm ditch to confirm the transfer of dyed water from the **storm sewer**/storm ditch to the **sanitary sewer**. The final step involves the television inspection of the **sanitary sewer** concurrent with dyed water flooding to pinpoint the exact location(s) of the defect(s) in the **sanitary sewer** that allow **stormwater** to enter the **sanitary sewer**. In some cases the entry point is on the **sanitary sewer** service lateral, not the main line sewer. Removal of the cross-connection(s) will therefore require rehabilitation of the service lateral. In most cases, the peak rate of wet weather flow from **sanitary sewer**/**storm sewer** cross-connections results in them being classified as High Priority Deficiencies. Direct and indirect cross-connections found during the condition assessment performed as part of the Short Term Requirements must be repaired within one year of identification. Direct cross-connections include locations where the **storm sewer** or storm inlet/catch basin is directly piped into the **sanitary sewer**. These direct connections are unusual. Indirect cross-connections are locations where **stormwater** flows from a **storm sewer** pipe or storm ditch down into the **sanitary sewer** via a soil seam, as illustrated in Figure 8.13. The most common type of indirect cross-connection involves **stormwater** from a storm ditch or **storm sewer** flowing down through an open soil seam and into a service lateral located directly under the **storm sewer** or storm ditch. Many **storm sewers** were constructed without pipe joint materials, or the pipe joints have deteriorated enough over time to permit **stormwater** to flow out of the **storm sewer**. The magnitude of flow from an indirect cross-connection can be significant, in some cases approaching that of a direct cross-connection.

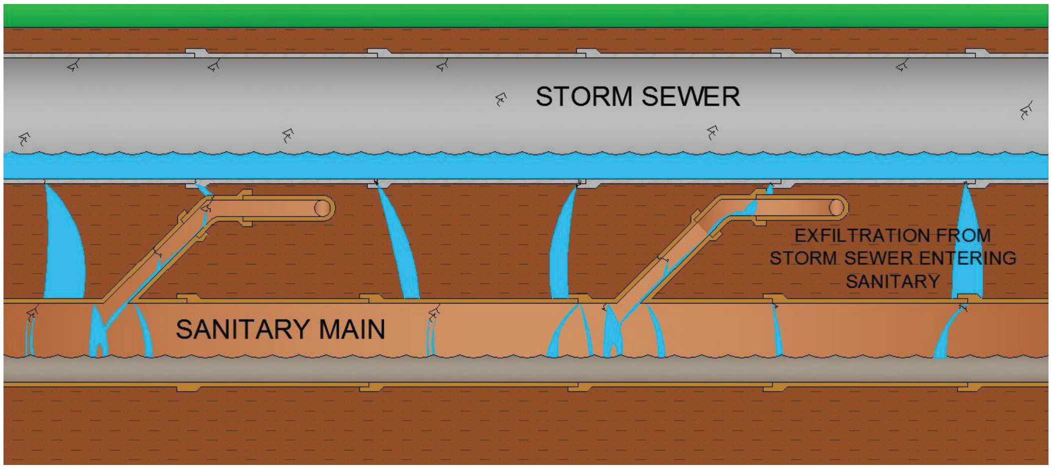


Figure 8.13. Storm-to-Sanitary Sewer Cross-Connection

High Priority Private Sector Deficiencies

All connections that allow **groundwater** or **stormwater** into the **sanitary sewer** are illegal and are considered High Priority Deficiencies. However, the removal, disconnection and/or rehabilitation of high-cost I/I sources (e.g., service lateral, foundation drains, driveway drains, area drains and window well drains) may be addressed under a **LTOMP**.

Low-cost High Priority Deficiencies corrections include: downspout disconnections (Figure 8.14), replacing missing and/or damaged cleanout caps/covers and addressing poorly disconnected downspout drains that act as area drains. These High Priority Deficiencies must be addressed within one year of identification.

Downspout connections and open cleanouts can be identified through **sanitary sewer** smoke testing programs and/or visual inspections. In some cases, downspouts that discharge underground may not smoke, and will require follow-up dye testing to confirm whether the downspout is connected to the **sanitary sewer**. In other cases, downspouts that were disconnected from the **sanitary sewer** by plugging the lead line from the downspout will be identified during a smoke testing program and may require follow-up due to deterioration of the plug over time.

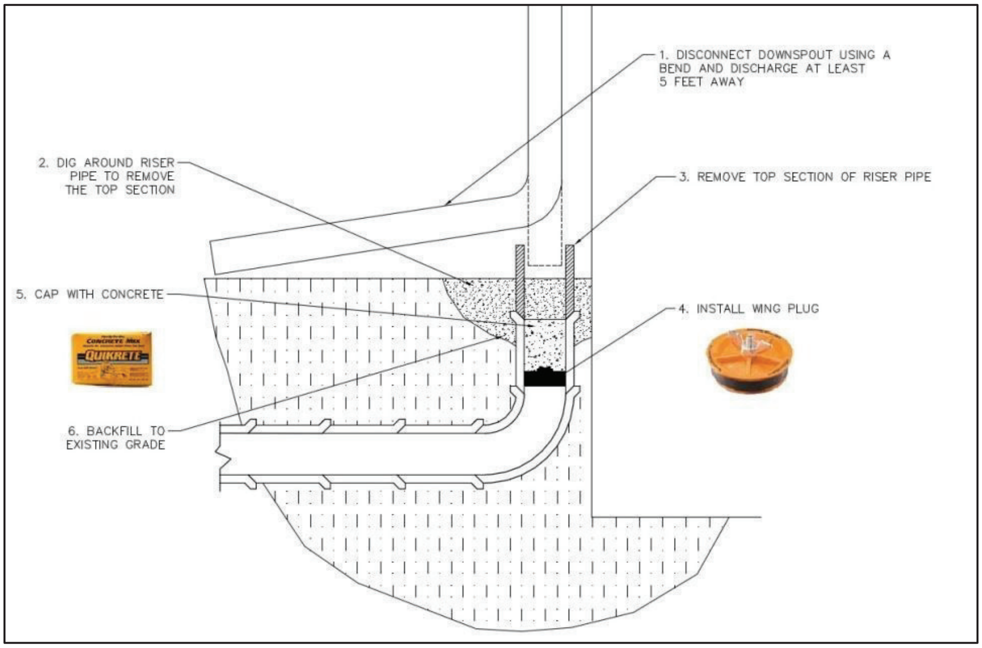


Figure 8.14. Typical Remediation of Connected Downspouts

Sewer System Rehabilitation

Sanitary sewer and manhole rehabilitation must take place for High Priority Deficiencies found during the condition assessment. Additionally, any connected downspouts, poorly disconnected downspouts, and cleanouts that are missing caps/covers will be required to be disconnected and/or repaired. These types of deficiencies can contribute large amounts of I/I into the **sanitary sewer** system. **Satellite entities** may need to work with property owners to correct these deficiencies; however, low-cost defects must be corrected within one year of identification.

Satellite entities must complete a *Status of High Priority Deficiencies Form* for tracking the status of High Priority Deficiencies that are not fixed by the end of the year in which they are identified. This form must show an identification number for each High Priority Deficiency, the date identified, the anticipated correction date, actual correction date, the means of correction and the **District** permit number under which the correction was performed. If any deficiencies are to be addressed by in-house staff, this should be noted on the form. This form is to be updated annually and submitted to the **District** with the Short Term Requirements Annual Summary Report. High Priority Deficiencies can be removed from the form only after the deficiencies have been corrected and the Actual Correction Date has been reported to the **District** as part of the annual report. An example of selected entries in the *Status of High Priority Deficiencies Form* is shown in Figure 8.15.

As indicated earlier, credit may be given for condition assessments of high priority sewers performed by a **satellite entity** in the five year period preceding the effective date of the IICP. If high priority deficiencies have been identified during these pre-IICP condition assessments but have not been addressed, these must be included on the *Status of High Priority Deficiencies Form*.

For High Priority Deficiencies that cannot be corrected and/or addressed in the short term, the **satellite entity** must prepare a CIP. The CIP will detail the plan and schedule for the long term correction of all identified High Priority Deficiencies. Information to be included in the CIP includes the name of capital projects, description of project areas, project cost, project funding source, anticipated project start date, duration, and project completion date. A sample CIP is included in Appendix D. The CIP should identify publicly funded projects to address items on the *Status of High Priority Deficiencies Form*. The CIP should not include **maintenance** work performed by in-house staff. The CIP must be submitted as part of the Annual Report and should be updated to indicate items that have been corrected and to include newly identified High Priority Deficiencies. Rehabilitation work to correct High Priority Deficiencies must begin within three years of identification of the deficiencies. One of the means by which the **District** will monitor progress under the IICP will be through its permitting process. **Satellite entities** are reminded that a **District** permit will be required for **sanitary sewer** system repair and rehabilitation work. The scope of work to be performed under a project will determine whether a **Watershed Management Permit** or a Notification and Request for Inspection will be required. **Satellite entities** are encouraged to contact the **District** for assistance in determining which type of permit is appropriate.

ONE YEAR DEFICIENCIES						
Deficiency ID	**High Priority Deficiency Type**	**Date Identified**	**Anticipated Correction Date**	**Actual Correction Date**(1)	**Means of Correction**	**District Permit Number**(2)
P-0016	Directly connected downspout	6/16/15	4/17/16	Future	Property owner to disconnect and install rain barrel	Not required
P-0103	Missing cleanout cap	6/20/15	4/1/16	Future	Property owner to replace	Not required
0984	Storm sewer connected to sanitary at Lake and Wagner	7/18/15	7/18/16	Future	Part of FY2016 Sewer Cleaning/CIPP lining contract	15-5133
0735	Stormwater in pond at Pleasant Park infiltrates into 8” san. sewer	7/20/15	7/20/16	Future	Line sewer as part of FY2016 Sewer Cleaning/CIPP lining contract	15-5133
THREE YEAR DEFICIENCIES						
Deficiency ID	**High Priority Deficiency Type**	**Date Identified**	**Anticipated Correction Date**	**Actual Correction Date**(1)	**Means of Correction**	**District Permit Number**(2)
1234	Main line Fracture Multiple	5/1/2015	10/1/2016	Future	FY2016 Sewer Cleaning/CIPP lining contract	15-5133
1956	Deformed sewer main line, 20’	5/15/2015	10/15/2017	Future	Wagner Road Sewer and Water Main Replacement Project	No permit yet
2668	Main line Infiltration Gusher	6/1/2015	10/1/2017	Future	FY2017 Sewer Cleaning/CIPP lining contract	No permit yet
2969	Visible reinforcement in manhole	6/23/2015	10/1/2016	Future	FY2016 Sewer Cleaning/CIPP contract	15-5133
3143	Manhole chimney I/I - IG	6/30/2015	10/15/2016	Future	Smith Avenue Road Repair Project	No permit yet
4217	Infiltration runner in manhole	5/3/2015	6/1/2016	Future	Manhole Repair contract	16-5003

(1) Entries in this column will all be “Future” in the first Annual Report, but will contain actual completion dates in subsequent reports as repair work is performed.
(2) Enter the permit number once it is issued.

Figure 8.15. Sample Entries into Status of High Priority Deficiencies Form

Development of the Private Sector Program

Each **satellite entity** is required to develop and submit to the **District** for approval a **Private Sector Program** (**PSP**) that will detail the means and methods for on-going internal and external I/I source identification and the removal of these sources. The goal of the **PSP** is to reduce **BBs** and **SSOs** by removing I/I sources. **Satellite entities** that do not already have inspection ordinances in place will need to enact ordinances granting them authority to conduct inspections and take enforcement actions for **PSP** compliance. A procedure to notify owners of the inspection, and to obtain consent must be established. The procedure must detail steps to be taken in the event consent is not given, such as fines, denial of service, obtaining a warrant and litigation, as well as procedures for handling non-compliance. The **PSP** will need to address how private sector I/I sources identified during the Short Term IICP inspections will be addressed. The **PSP** should be adequately funded and staffed with qualified personnel to implement the program. See Appendix D for a sample **PSP**.

The following items further describe what is required for a PSP:

1. Staff / Training / Authority

   Adequate and appropriately trained/qualified staff and/or contractors will be provided to implement all necessary components of the **PSP**. An organizational structure should be established that clearly defines responsibilities and authority for all staff. Staff should be periodically trained in their respective responsibilities including how to conduct internal and external property inspections, and how to document findings consistently. Staff must be equipped with necessary and proper equipment, tools and materials (smoke/dye/flood testing, camera, etc.) to perform the work required under the **PSP**. As part of the **PSP**, **satellite entities** must list the staff job titles that will have responsibility for implementation of the **PSP** and an estimated number of hours per month that will be allocated to work on the **PSP**.

2. Local Authority

   Satellite entities will be required to enact ordinances, resolutions, bylaws, and/or access agreements that will provide authority to gain access to properties for I/I source inspection and identification, and to enforce **PSP** compliance, if they do not currently have such legal measures in place. Such agreements must provide **satellite entities** with authority to conduct exterior and interior inspections of private property. **Satellite entities** should have legal counsel to advise them for any proceedings toward owners that refuse access for inspection. As part of the **PSP**, **satellite entities** must provide a copy of their ordinances, resolutions, bylaws, and/or access agreements that give them the authority to conduct inspections for I/I sources.

   Examples of Inspection and Enforcement Ordinances are posted on the **District's** website at: https://www.mwrd.org/irj/portal/anonymous/Infiltration. Most of the examples are from **satellite entities** within the **District's** service area.

3. Inspection

Satellite entities must develop a private property inspection program to address the disconnection of illegal private infiltration and inflow sources. In general, inspections are to be made in areas where private sector I/I appears to be a significant contribution of the overall I/I in a system. At a minimum, if a portion of the satellite system experiences **BBs** and/or **SSOs** during multiple wet weather events within one 12-month period and if the public sector **sanitary sewer** system has no unrehabilitated High Priority Deficiencies, then the **satellite entity** should conduct inspections of private properties in the impacted area, upstream areas, or any other areas that the **satellite entity** believes may be contributing to the **BBs** and **SSOs**. **Satellite entities** may include additional criteria for conducting private property inspections as part of their **PSPs**. A written description of the private property inspection program, including all inspection checklists, sample notice letters, door hangers, and documentation of non-compliance, must be submitted to the **District** as part of the **PSP**. Note that the inspection program should have clear procedures for notification to property owners, obtaining consent for inspections, and procedures for properties where consent is not given, such as fines, denial of service, obtaining a warrant and litigation. **Satellite entities** are urged to consult an attorney when developing inspection procedures to ensure constitutional protections of private property rights are not violated.

Inspections will be conducted to locate and identify private property internal and external I/I sources and to document all sewer connections. **Satellite entities** may wish to use the authority provided by sewer use ordinances and private property inspections for **building** permits to ensure that sanitary and **stormwater** utilities on private property are properly connected as to prevent the allowance of I/I sources connected to **sanitary sewers**. Implementation of the program can be coupled with water meter readings or replacements, water heater, furnace, or air conditioner replacement, roadway reconstruction or resurfacing projects, and etc. A list of I/I sources should be created and added to an inspection checklist. A sample checklist is included in Appendix D. Ideally, all properties will be inspected on a 10-15 year cycle with priority given to areas known to have **SSOs** and **BBs** and areas upstream. In addition, more frequent inspections may be necessary depending upon the system's condition (e.g., sewer age and material, areas that connect I/I sources to the sewer system during original construction, history of violations, **SSOs** and **BBs**, and etc.).

Internal **building** inspections typically include visual inspections of sump pumps and sump pump discharge piping, and may include insertion of dyed water into sump pits if the discharge location is indeterminate by visual inspection alone.

External home inspections may also be periodically employed to identify potential private property I/I sources visible from outside the property, such as downspouts, area drains, or defective cleanout caps. Visual inspections can identify I/I sources from cleanouts and potential I/I sources from area drains and downspouts that discharge underground. Smoke testing is the most effective starting point for identifying external private property sources.

However, dye testing is often required to trace and confirm the discharge locations of area drains and downspouts that terminate underground.

An inspection of the lateral is recommended when other I/I sources have been ruled out. The following tests should be utilized: visual, smoke testing, dye testing and CCTV. Inspection of laterals should be conducted according to NASSCO Lateral Assessment and Certification Program (LACP®) standards, and diligence should be taken to cross-reference LACP® inspection data with PACP® data from inspections of connecting public sewer mains to properly establish where connections are located.

A hierarchy of various sewer connection and/or condition status should be established and documented upon inspection. Examples of status are: compliance, partial compliance (e.g., sump pump connected, downspout disconnection), and non-compliance. Special care should be taken when classifying connections for non-compliance. For example, both a downspout and a foundation drain tied into the **sanitary sewer** are illegal connections. However, disconnection of the downspout(s) is relatively easy and must be completed in the short term and should be categorized as non-compliant, whereas, the foundation drain connection is generally a long term correction item and may not trigger an immediate non-compliance notification. The **District** considers footing drains, driveway drains, and leaking laterals to be high-flow, high-cost private sector I/I sources. Although **satellite entities** are encouraged to work with property owners to have these high-flow, high-cost private sector I/I sources addressed quickly, the **District** recognizes that the cost of such repairs may make this difficult. Therefore, **satellite entities** are required to establish a long term program under which such high-flow, high-cost private sector I/I sources may be addressed.

4. Non-Compliance Correction

   A notification and correction procedure must be established to notify, assist, and educate owners of non-compliance. The procedure should include how the owner is notified, a schedule to correct the non-compliance, and verification through re-inspection.

   The notification must include a letter to the property owner describing the non-compliant condition, stating the date by which the condition must be corrected, and describing legal actions that will be taken by the **satellite entity** if the owner does not correct the condition. The notification may also include educational material on the type of disconnection/rehabilitation required, a list of bonded/insured contractors in the area capable of performing the work, information regarding funding assistance provided by the **satellite entity** and/or regional agency.

5. Long Term Program to Address High-Cost I/I Sources

   As indicated above, the **District** recognizes that many sources of private sector I/I are costly to remove. Satellite system owners must establish a program that documents which properties have high-cost, high-flow I/I sources, which includes footing drains, driveway drains, area drains, and leaking laterals. Information on such sources gathered through municipal records and/or inspections must be documented and stored in perpetuity. The long term program must establish means by which such I/I sources may be removed. This section of the **PSP** must address identification and correction of private sector I/I sources identified during the first five years of the IICP. Establishing and promoting cost-sharing programs for correcting such sources, and enacting ordinances requiring removal of such sources in conjunction with tear-downs or major home improvements are examples of components of a long term program. A sample long term program is included with the **PSP** example in Appendix D.

Ultimately, **satellite entities** are to use discretion to determine the extent to which removal of high-flow, high-cost private I/I sources must occur, in conjunction with any other sewer system improvements, to achieve the IICP goals of reducing **BBs** and **SSOs**.

6. Enforcement

   A hierarchy of enforcement actions should be established when an owner fails to comply with a notification of non-compliance. Enforcement action(s) must be established through the enacted ordinance of the **satellite entity**. The hierarchy should be structured such that an escalation of penalties occurs. Examples include fines, denial of service and litigation.

7. Funding

   The **PSP** must be appropriately funded every year. All costs should be tracked to develop subsequent **PSP** budgets such that any future rate increases are justified if they are needed. In general, the **PSP** will be funded as part of the **satellite entity's sanitary sewer maintenance** program. As part of the **PSP**, **satellite entities** must identify the amount of money they intend to allocate towards the **PSP** each year, in addition to identifying the source of the funding.

8. Public Information

   Educational/outreach programs should be created and promoted to introduce the general public, new property owners, realtors and area plumbers to the **USEPA**, state and local regulations requiring I/I control and the **PSP**. Such programs should also explain the public health, environmental, regulatory and other benefits of I/I reduction efforts, and inform the public of their responsibilities related to the I/I problem. Public outreach should include information regarding basic I/I education, how the individual can help with reducing I/I, and information regarding new ordinance and inspection requirements. Brochures, village publications, websites, mailings, inserts in water bills, and emails can convey this information. As part of the **PSP**, **satellite entities** must describe their public information program and must attach any brochures or publications they distribute about private sector I/I control. Such materials must be reviewed every ten years and updated if necessary.

Each satellite system owner must submit a **PSP** to the **District** within five years of the effective date of the IICP. Each satellite system owner must report on the progress of development of its

PSP on the Short Term Requirements Annual Summary Report. Examples of activities to report during the development of the **PSP** include:

- Drafting language for inspection and required disconnection ordinances;
- Determining requirements for private sector inflow source removal cost-sharing programs(1);
- Developing a brochure about private sector inflow source removal cost-sharing programs including plumbing;
- Details for acceptable disconnection materials and methods(1);
- Establishing variance procedures for unique individual disconnections related to unreasonable cost or lack of a feasible discharge location;
- Developing rules and application forms for private sector inflow source removal cost-sharing programs(1);
- Adopting ordinances for inspection programs(2);
- Adopting ordinances for cost-sharing programs(1);
- Developing private property inspection procedures;
- Establishing rules and ordinance language related to overhead sewer installation;
- Establishing rules and ordinance language for periodic re-inspection of homes;
- Establishing rules and application forms for backflow prevention devices, with and without pump-over capability(1) (2);
- Establishing policy and ordinance language for elimination of all clear water sources in conjunction with a “tear down” or major renovation(1);
- Establishing policy and ordinance for inspection of homes for compliance as part of all property transfers(1) (2);
- Posting all relevant documents and forms on the satellite system website and/or newsletters;
- Training staff on how to conduct inspection of private property; and
- Entering into agreements with consultants to conduct inspections of private property.

(1) This is recommended, but not mandatory.
(2) Please visit the **District’s** website to see examples of similar programs administered by local satellite sewer system owners.

Reporting of Sanitary Sewer Overflows and Basement Backups

The **District** will use information about **SSOs** and **BBs** to view trends over time within individual **satellite entities**. Implementation of an effective I/I control program and sewer **maintenance** and rehabilitation program within a **satellite entity’s** sewer system should result in fewer **SSOs** and **BBs** during low to moderate recurrence interval wet weather events over time. Therefore, under the IICP, **satellite entities** are required to keep records on all **SSOs** and **BBs** that occur within their system. A *Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary Form* must be completed for every **SSO** or **BB** that occurs within a **satellite entity’s sanitary sewer** system. These forms do not need to be submitted to the **District** unless the **District** requests them.

Information about **SSO**s and **BB**s within the **sanitary sewer** system must be provided where indicated on the Short Term Requirements Annual Summary Report and on the **LTOMP** Annual Report. In general, causes of all **SSOs** and **BBs** should be determined and these causes should be corrected to prevent future **SSOs** and **BBs**.

Auditing

The **District** reserves the right to audit any **satellite entity** following submittal of the Short Term Requirements Annual Summary Report. The purpose of such audits is to:

- Review condition assessment and inspection documentation;
- Verify the quantity of assessment work performed within reporting years;
- Verify that assessments were conducted according to NASSCO standards, or approved equivalent standards;
- Verify that repairs of High Priority Deficiencies have been performed;
- Review records of private property inspection program;
- Review list of properties with high-flow, high-cost I/I sources; and
- Verify that detailed records on **SSOs** and **BBs** are kept.

LONG TERM O&M PROGRAM (§805)

The **sanitary sewer** system is designed to remove wastewater from homes and other **buildings** and convey it to the **District's** water reclamation plants (WRPs). A **sanitary sewer** system that is not properly designed, managed, operated and maintained can pose potential risks to the environment and public health. These risks arise through system failures or when I/I flow enters the **sanitary sewer** system through defects and/or deficiencies. I/I flows reduce sewer system capacity which results in **SSOs** and **BBs**. Therefore, a **LTOMP** is required for a successful I/I control program. The **LTOMP** shall be continually implemented by **satellite entities** to maintain **sanitary sewer** system capacity and performance, thereby reducing **SSOs** and **BBs**.

A major, often over-looked, portion of the **sanitary sewer** system is the private sewer system. The private sewer system can account for as much as 50% of the entire sewer system. Recent published studies have documented that up to 80% of I/I enters the sewer system through private sector sources. Therefore, in addition to the aforementioned **LTOMP**, a **PSP** is required to achieve meaningful I/I control and reduction. The **PSP** shall be continually implemented by all **satellite entities** to identify and remove internal and external I/I sources, thereby reducing **SSOs** and **BBs**.

The **LTOMP** and **PSP** should be adequately funded and staffed with qualified personnel to implement the program.

Requirements for the **LTOMP** and **PSP** are based in part on the **USEPA**'s Capacity, Management, Operation and Maintenance (CMOM) guidelines. CMOM is a flexible, dynamic framework for **sanitary sewer** system owners to identify and incorporate widely accepted wastewater industry practices to better manage, operate and maintain collection systems, investigate capacity-constrained areas, and respond to **SSO** events.

The CMOM program was developed in an attempt to establish a process and framework that would allow collection system owners and operators to:

1. Understand the components that the collection system is composed of, as well as understanding how the collection system performs.
2. Identify goals and objectives for managing a specific collection system.
3. Ensure that appropriate program components are in place, including administrative and **maintenance** functions, legal authorities, and design and performance standards.
4. Strive for adjustment of implementation activities to reflect changing conditions; including monitoring and measuring program implementation and making appropriate modifications, conducting necessary system evaluations, implementing a capacity assurance program, and conducting periodic program audits to evaluate implementation, identify deficiencies and to generate steps to respond to them.
5. Prepare for and respond to emergency events.
6. Communicate with interested parties on the implementation and performance of the CMOM program.

In 2001, **USEPA** proposed a rule under which CMOM programs would have been required of **sanitary sewer** system owners in their **NPDES** permits. This rule was never adopted at the federal level, however, some states have taken steps to implement CMOM programs through **NPDES** permits. For example, the IEPA has included special conditions in **NPDES** permits issued to the **District** in 2013, that require development of CMOM plans for the **District's** own collection facilities.

The **District's** website includes a link to **USEPA**'s Guide for Evaluating CMOM Programs. **Satellite entities** are encouraged to review this reference as they prepare their **LTOMP**. Several specific recommended practices aimed at reducing reactive **maintenance** and fostering more effective proactive **maintenance** programs are described in this document.

The following items describe what will be required for an LTOMP:

1. Sewer System Management

   Sewer System Management includes staffing, training of staff, standard operating procedures, and tracking of **maintenance** activities and complaints. Clearly defined procedures, management and training are required for effective O&M activities to reduce potential risks to the environment and public health.

   a. Staff, Training and Safety

Staffing with **satellite entity** personnel and/or subcontractors will be provided to implement necessary components of the **LTOMP**. **Satellite entities' LTOMPs** must establish an organizational structure that clearly defines responsibilities and authority for all personnel including operation and **maintenance** staff.

Staff should be periodically trained in their respective responsibilities. Training should be provided for the following: public relations and customer service, safety, sewer O&M activities, lift station O&M activities, **SSO**/**BB** emergency response, sewer inspection, repair, rehabilitation and replacement. **Satellite entities' LTOMPs** must include a description of the staff training program.

Internal communication procedures should be established to coordinate and/or advise staff of information regarding the implementation or performance of the **LTOMP**.

Staff must be provided with required safety equipment to perform the work required under the **LTOMP**, and safety procedures must be provided to staff in writing (including procedures, policies and training courses). Safety equipment must be maintained for the staff to perform daily activities and undertake any emergency repairs.

The purpose of a safety program is to define the principles under which the work is accomplished, to establish safe working procedures, and to establish and enforce specific regulations and procedures. The safety program should be in writing (including procedures, policies and training courses) and training shall be documented. Safety measures to be taken when developing or improving a sewer **maintenance** program are described in detail in Chapter 9 of the 1989 Manual.

Personnel involved in **sanitary sewer maintenance** activities need to be aware of the many safety risks inherent with **sanitary sewer** systems. Risks associated with explosive gases, oxygen depletion, toxic gases, pathogens, engulfment, falling objects, traffic control, tripping and falling all must be mitigated when preparing to enter a manhole or sewer. Completing a confined space entry permit and work plan prior to entering a manhole will help to ensure that participants are aware of all of the equipment they will need as well as insuring that they are aware of unique challenges to a particular task. All **sanitary sewer maintenance** crews shall have access to and training on the use of portable gas detectors, which produce visual and audible warnings when hazardous atmospheres are detected.

Satellite entities should have written lock-out and tag-out procedures and provide training on these procedures. The purpose of lock-out and tag-out protocols is to ensure that equipment cannot be operated while it is being serviced (such as a pump undergoing **maintenance**). Such procedures also protect people working in areas that could become unsafe for human occupation if the locked out equipment could be operated. Tags and locks should be placed on the equipment by all parties involved in operating the equipment, as well as by the parties who need the equipment locked, so that equipment cannot be restarted until all affected parties verify that it is safe to do so.

Training for new employees and routine refresher training for existing employees is essential to any effective safety program. **Satellite entities** should designate a staff member who is responsible for keeping track of when each employee received training on a particular topic, and when they must take a refresher course.

Safety training and programs should be in place for the following:

- Confined spaces
- Chemical handling
- Trenching and excavations
- Material Safety Data Sheets (MSDS)
- Biological hazards
- Traffic control and work site safety
- Lock-outs and Tag-outs
- Electrical and mechanical safety
- Pneumatic and hydraulic systems

Safety equipment should be maintained for the staff to perform daily activities and undertake any emergency repairs. Staffing levels should be adequate to assign an appropriate number of staff to tasks with inherent risks.

b. Customer Service

A customer service and/or public relations program should address any incoming inquiries, requests and complaints. A record of all inquiries, requests and complaints should be kept and should include date received, location, customer information, date resolved, etc. When receiving reports of **BBs**, staff should gather information, if available, on depth of flooding in basement, whether the backup was preceded by a storm event, whether there was a power outage prior to the **BB**, and how long it took for the backup to recede. **Satellite entities' LTOMP**s must include protocols for handling inquiries, requests and complaints from the public.

c. Management Information Systems

A Computerized Maintenance Management System (CMMS) should be used to effectively manage current information related to the collection system. A CMMS system should be able to track and maintain records of customer service, emergency response, inspections, monitoring, compliance, **maintenance**, asset inventory, equipment and supply inventory, etc. **Satellite entities**' **LTOMPs** must include a description of the system used to track the aforementioned information about the **sanitary sewer** system.

A Geographical Information System (GIS) should be used to map and locate facilities and provide information on all municipal infrastructure (material, size, elevations, etc.). The GIS and CMMS systems should be integrated.

d. SSO/BB Notification Program

A procedure must be established for reporting an **SSO** to appropriate parties, when required. Such entities may include the **IEPA**, drinking water officials, public health officials, transportation officials or the general public. A summary of **SSOs** and **BBs** must be provided to the **District** annually. Information about each **SSO** and **BB** that occurs within a **sanitary sewer** system, whether in the private public sector, must be recorded on the *Sanitary Sewer Overflow or Basement Backup Satellite Entity Internal Summary Form*. Typical information recorded about the **SSO** event includes date, time, location, cause, volume, how it was stopped and remediation actions and methods. A procedure for cleaning a site following an **SSO** should also be included in the **LTOMP**.

A procedure must be established for responding to and inspecting **BBs**. Typical information recorded on the aforementioned form about the **BB** event should include: date, time, location, cause, volume, how it was stopped, remediation actions and methods, depth of flooding in basement, whether the backup was preceded by a storm event, whether there was a power outage prior to the **BB** and how long it took for the backup to recede.

e. Emergency Preparedness and Response

Satellite entities' **LTOMP** must include a written plan for both routine and catastrophic emergencies. These emergencies include **SSOs**, **BBs**, sewer breaks or collapse, power outages at lift stations, etc. The emergency response plan should utilize the most current information about the collection system and should be available to the staff. For larger systems, the collection system should have a risk assessment, identifying areas where the collection system is vulnerable to failure, as well as the effect failure would have to system operation, equipment, public safety and health. A risk assessment should consider the vulnerability of the system to the following:

- Extreme weather events and other natural disasters;
- Work stoppages;
- Accidents; and

- Improper **maintenance** or negligence.

Once vulnerable areas are known, appropriate plans should be in place to ensure system operation continues for the duration of the emergency. Plans should address contingencies for emergency conditions, including:

- Inaccessibility of equipment or system components;
- Equipment failures;
- Power outages; and
- Lost or difficult communication caused by noise, equipment failure, or service outages.

Plans should identify all steps that staff should take in the event of emergency situations. Plans should also indicate when they should be initiated and terminated. Finally, plans should detail the type of equipment that should be used in various situations and how operations should be performed.

Typical components of an emergency program may include the following:

- General information, such as telephone numbers of personnel, fire department and ambulance;
- Identification of hazards with classification, e.g., flammable, energized electrical circuits, etc.;
- Risk assessment for vulnerabilities which identifies what type of emergencies that could occur;
- Emergency response procedures;
- Methods to reduce the risk of emergencies;
- Responsibilities of staff; and
- Continuous training.

Emergency procedures should be understood and practiced by all staff. Records of all past emergencies should be kept in order to constantly improve response training and the method and timing of future responses. If resources are limited, consideration should be given to contracting other departments or private industries to respond to some emergencies.

2. Mapping

Satellite entities are required to have an accurate, current map of their **sanitary sewer** system. This map shall be submitted to the **District** as soon as it is available, but no later than the time at which the **LTOMP** is submitted to the **District**. Chapter 2 of the 1989 Manual discusses sewer mapping. An accurate map of the location, size, depth, material, and age of the **sanitary sewer** system including appurtenances is vital for effective operation and **maintenance** activities. The map must also show the extent of the **satellite entity's** sewer system service area. Many satellite sewer system owners will have area maps and section maps. Area maps are drawn at a larger scale and help orient the reader to the area of interest. A section map can then be consulted for detailed information about the sewer system in one area. Sewer system maps should be developed, if they do not currently exist, or updated prior to developing and implementing **maintenance** activities.

Maintenance of the sewer map by updating all relevant information about the collection system is vital. Maps should contain the following information:

- All mainline sewers and force mains;
- Manholes and cleanouts;
- Lift Stations, siphons, diversion structures, overflows and bypasses;
- **Building** and house laterals' connection points to mainline sewer;
- Service area boundaries[1];
- Roads, water bodies, etc.;
- Connections to **District** facilities;
- All relevant elevations, diameters, sizes, and materials of the above; and
- The footprint of **buildings** served by the public sewer system (for **satellite entities** that have digitized maps, as described below).

[1] Examples of the types of service area boundaries that should be shown on a sewer map, if applicable in a particular **satellite entity** include: **combined sewer areas**, **separate sewer area**s, unsewered areas, areas that are tributary to a particular **District** treatment plant (if the **satellite entity** discharges to more than one treatment plant), and areas tributary to the **District** versus another sanitary district.

The maps should have a permanent numbering system to uniquely identify all manholes and cleanouts, and these numbers should never change. Manholes should be labeled with rim and invert elevations. Sewer lines should indicate the diameter, length between manholes, material, and slope or direction of flow. The maps should also have access and overflow points, a scale, and a north arrow. It is recommended that **regulatory floodplains** be shown on the maps, as well as other utilities such as **storm sewer** and water mains, as long as the information about **sanitary** and **combined sewers** remains clearly visible. The maps should also have the date the map was drafted and the latest revision date.

A Geographical Information System (GIS) is preferable to be used for collection system mapping, as it is efficient to update. Information is more easily obtained from a map in GIS than from map in other formats (i.e., paper). GIS easily allows for the printing of maps at the user's choice of scale. Separate steps are not required to generate area maps and section maps, since a map book feature can be used to generate the large-scale map which facilitates locating specific information from a section map. Staff should be properly trained in the use of GIS mapping. Figure 8.16 shows an example of a **sanitary sewer** map in GIS format.

Figure 8.16. GIS-Based Sewer System Mapping

While many **satellite entities** in the **District** service area have already transferred their sewer maps to GIS, several still use paper maps. Transferring the mapping system to GIS is strongly recommended. In addition to the benefits mentioned above, adding new fields of information to the map can be accomplished more easily in GIS. Locating structures (such as manholes) in the field is easier because a current aerial photo can be switched on as a base map. Viewing sewer information - along with other information, such as locations of **storm sewers**, water mains, **floodplains**, gas mains, municipal boundaries, etc. is easier because feature classes of these types of data can be stored in the system and switched on and off as needed. Transferring sewer and utility data to GIS from paper requires an investment of monetary resources to purchase the software, digitize data, provide adequate computer hardware, and pay for future system upgrades. The transfer of sewer system data to GIS also requires an investment of staff time to check the electronic data and to learn how to use the new system. Satellite system owners considering transferring sewer system data to GIS are urged to take the necessary time to ensure that data being digitized is correct. If poor quality, erroneous data on paper maps is simply re-drawn in digital format, the data will still only be marginally useful. Therefore, it is recommended that a review of paper maps be made - especially in conjunction with transferring the sewer map to a GIS format - to identify and resolve issues such as missing rim and invert elevations, adjacent invert elevations that do not seem reasonable or realistic (such as a downstream manhole invert that is higher on a gravity line), **sanitary sewers** that do not connect to anything or dead-end at a manhole, and **sanitary sewer** sizes that seem unreasonable or unrealistic (such as a larger pipe connecting to a smaller downstream pipe). The most accurate method to build a **sanitary sewer** layer in a GIS system involves the establishment of an accurate GPS location for each manhole from recent field investigations.

Specific procedures should be established when correcting or entering new information into the GIS map. It is recommended that updates to sewer maps be handled by, or at least approved by, a single designated staff member. The procedure for updating maps should require updates to be made quickly. Typical items that would require periodic updating include:

- New sewer system extensions and additions;
- Changes to the sewer as a result of replacement or rehabilitation;
- Changes to appurtenances as a result of replacement or rehabilitation;
- Location of service lateral connections to the mainline sewer after a television inspection is completed, if such information is not already available;
- Corrections to map errors; and
- Documentation of completed rehabilitation work.

Satellite entities' **LTOMPs** must include a procedure for updating the **sanitary sewer** map. Updates to the sewer map shall be made annually, at a minimum.

3. Equipment and Collection System Maintenance

Every sewer system should have a well-planned, systematic and comprehensive **maintenance** program, with the goals of preventing and eliminating **SSOs** and **BBs**, maximizing service and system reliability at minimal cost, and establishing infrastructure sustainability. Procedures and instructions should be in place to describe the **maintenance** and repair approach of various systems and facilities.

Maintenance can be planned or unplanned. Planned **maintenance** activities include predictive and preventive **maintenance**. Unplanned **maintenance** consists of corrective and emergency **maintenance**. The goal is to reduce corrective and emergency **maintenance** through planned and predictive **maintenance**. Each **satellite entity's LTOMP** must include a description of how it approaches planned and unplanned **maintenance**.

a. Planned and Unplanned Maintenance

A planned **maintenance** program is a systematic approach to performing **maintenance** activities to avoid equipment or system failure. Planned **maintenance** includes both predictive and preventive **maintenance**. A well planned **maintenance** program should reduce capital repair and replacement costs, reduce **SSOs** and **BBs** and improve and sustain public confidence in the sewer system.

Predictive **maintenance** activities include assessment and inspection of equipment and the system, and monitoring equipment can be used to detect early warning signs of failure. Predictive **maintenance** also takes previously recorded information into account to determine how and when the system will deteriorate over time.

Implementing an accurate recordkeeping system of inspection activities will provide a baseline condition of the system which can then be used to implement an effective predictive **maintenance** program that identifies potential problem areas and trends that could affect equipment and system performance. This can be achieved by utilizing a CMMS. Identification of these areas will offer an early warning and shift a corrective or emergency task to a planned task.

An effective predictive **maintenance** program will minimize costs, reduce environmental and public health impacts, reduce the need for corrective and emergency repairs, and increase the useful life of the equipment and system.

Maintenance of mechanical equipment, such as lift stations, should be based on the manufacturer's recommendations. A **maintenance** card or digital record should be kept for all equipment within the **sanitary sewer** system. Records should be kept for all equipment that details **maintenance** recommendations, schedule and instructions as well as any **maintenance** activities conducted.

The schedule of sewer inspections, cleaning, root removal, repair, rehabilitation and replacement activities should be based on recorded inspection data. It should be noted that regular frequencies of cleaning, inspection and root removal may not be necessary and could be inefficient. In many cases a small percentage of the system has the most problems; therefore, the **maintenance** schedule should be based on the recorded inspection data.

Unplanned **maintenance** activities take place in response to equipment and/or sewer breakdowns or failures. Unplanned **maintenance** may be corrective or emergency **maintenance**.

Corrective **maintenance** occurs as a result of preventive or predictive activities or a non-emergency which has been identified as a problem situation. Emergency **maintenance** occurs when a failure occurs creating an environmental hazard, public health hazard, or a hazard to the related system or equipment.

Corrective **maintenance** activities may draw resources away from predictive and preventive **maintenance**. When corrective **maintenance** activities become predominant, planned **maintenance** may not be performed, leading toward an increase of corrective and emergency **maintenance** activities.

Emergency crews, or on-call emergency crews, must be in place for 24-hour-a-day, year-round operation to respond to emergency **maintenance** activities. A procedure should be established detailing the type of action to take, necessary equipment and the personnel required.

b. Sewer Cleaning

Satellite entities' LTOMP must include a protocol for sewer cleaning.

The purpose of sewer cleaning is to remove accumulated material, to prevent blockages and to prepare the sewer for inspections. The major methods of sewer cleaning include hydraulic, mechanical and chemical cleaning. Table 8-6 was developed by the **USEPA** and shows the relative effectiveness of various sewer cleaning methods that address specific issues commonly encountered in sewers. Sewer cleaning methods, and their respective advantages and disadvantages, are discussed on pages 5-1 through 5-40 in the 1989 Manual.

Hydraulic cleaning is the application of pressurized water to clean the sewer. Such methods include balling, high velocity cleaning with a nozzle and flushing. Mechanical cleaning uses a device to scrape, cut or pull material from the sewer. Such methods include sewer scooters, bucket machines, scrapers and power/hand rodders. Many local sewer system owners have access to combination vacuum/jetting trucks, like the one shown in Figure 8.17, to address a variety of sewer cleaning tasks.

Figure 8.17. Vacuum/Sewer Cleaning Truck (Source: Anaheim Truck & Auto Service, Inc.)

Another element of sewer cleaning, chemical cleaning, is commonly used to control roots, but can also be used to manage accumulated grease.

Roots are a concern for owners of sewers not only because they can grow inside of the sewers and block flow, but also because they can widen existing cracks or joints in the sewer, which may lead to increased **groundwater** infiltration. Roots can be removed through mechanical means such as rodding and jetting with cutting heads, however, chemical treatment is usually required in conjunction with these methods due to roots' tendency to grow back.

Some products designed to kill roots contain copper. Due to potential toxicity to microorganisms at downstream wastewater treatment plans, the use of products containing copper is not recommended. Active ingredients used in common root control chemicals include diquat dibromide and metam-sodium. Both can have harmful impacts on humans and the environment if they are not used as directed, but byproducts created when metam-sodium breaks down, particularly the gas Methyl isothiocyanate (MITC), pose significant health risks. The EPA restricts the use of metam-sodium products within 50 feet of a manhole in order to minimize the risk of exposure of bystanders to MITC.

Foam is the only available application method for metam-sodium and diquat dibromide root control products.

In recent years, an increase in sales of non-woven fabric wipes, particularly those that are not marketed as baby wipes, has correlated to increased incidences of blockages in sewers and pump station failures due to clogging. Several local sewer system owners have seen a sharp increase in the number of manhours dedicated to sewer cleaning associated with wipes and other debris that become trapped once they are in the sewer system. One of the most significant instances of this was the formation of a 15-ton bus-sized mass of debris in a London interceptor, given the nickname "fatberg." Discussions between industry groups representing wastewater collection facility owners and non-woven fabric manufacturers continue with the goal of finding a solution to conflicting recommendations for durability of wipes. In the meantime, sewer system owners need to be aware of the trend. They may consider initiatives to educate the public that inappropriate materials flushed down toilets can cause clogged pipes, service disruption and ultimately, increased sewer service rates.

Accurate records are needed to indicate which areas of the **sanitary sewer** system are susceptible to blockages. The records will aid in the development of a cleaning cycle to address problem areas more frequently. Potential problem areas should be identified, preferably on a map. Problem areas include: grease/industrial discharges, hydraulic bottlenecks, sewers with insufficient slope, areas prone to root intrusion, etc. An effective and economical cleaning cycle must be determined by each **satellite entity**. Cleaning is required prior to scheduled inspection and rehabilitation work.

Table 8-6. Relative Effectiveness of Sewer Cleaning Techniques
(Source: USEPA, 2002, Collection Systems O&M Fact Sheet Sewer Cleaning and Inspection)

Solution to Problem	Emergency Stoppages	Grease	Roots	Sand, Grit, Debris	Odors
Balling		●		●	●
High Velocity Cleaning	•	●		●	●
Flushing					●
Sewer Scooters		●		●	
Bucket Machines, Scrapers				●	
Power Rodders	●	•	●		
Hand Rods	●	•	●		
Chemicals		●	●		●

● = Most effective solution for a particular problem

• = Least effective solution for a particular problem

Source: U.S. EPA, 1993.

c. Lift Stations

Proper lift station operation, **maintenance** and repair typically requires electrical, hydraulic and mechanical knowledge. Lift station failure may damage equipment and endanger the environment and public health as a result of an **SSO**.

Information regarding lift station operation and equipment should be maintained to the fullest extent possible. Key operational parameters should be maintained in an organized and accessible manner and should be readily available to operators at all times. Key operational data to be collected and kept current include the following:

- Station drawings;
- Wet well dimensions and key elevations;
- Pump on/off levels;
- Level of influent pipes and tributary sewers relative to on/off set points;
- Pump model(s) and impeller trims;
- Pump curves and design points;
- Size of pump discharge piping and force mains;

- Types and condition of valves;
- Manufacturer data sheets for mechanical and electrical equipment; and
- Calibration records for level and flow monitoring equipment.

The lift station O&M manual should consider the variation of equipment types, configuration, etc., and should contain written procedures for the following:

- Automatic or manual pump rotation and frequency;
- Wet well operation levels to limit pump starts and stops;
- Procedure for manipulating pump operations during wet weather to increase in-line storage of wet weather flows;
- How flow is measured (if applicable) and how the collected data is used;
- Assessing whether the lift station has capacity related or **maintenance** related overflows, and whether overflow monitoring is and should be provided;
- Primary means of level control;
- Use of floats for primary or backup level control;
- Whether there is a history of power outages and a source of emergency power; and
- Procedure for regularly exercising the emergency generator (if present) under load.

d. Force Mains

When properly designed and maintained, force mains can have a useful life comparable to that of a gravity sewer. Annual force main route inspections are recommended to ensure normal functioning and to identify potential problems. Special attention should be given to the integrity of the force main surface and pipeline connections, unusual noise, vibration, pipe and pipe joint leakage and displacement, valve arrangement and leakage, lift station operation and performance, discharge pump rates and pump speed, and pump suction and discharge pressures. One common method of determining the condition of the force main is by routine pump station calibration. If this is done on an annual basis, any changes in capacity and discharge head in the pump station can be identified. Because these changes could also be attributed to pump wear, it is essential to verify that the pumps are in good working order before determining that the force main needs cleaning.

4. Material and Equipment

An inventory of spare parts, equipment and supplies should be maintained and based on the manufacturers' recommendations and/or historical records. This inventory will reduce the down time of the **sanitary sewer** system in the event of a failure. It is recommended that frequently used items be kept in stock as well as parts that are difficult to obtain. Safety equipment used by the sewer **maintenance** crew should also be included on the equipment inventory.

Basic equipment inventory should include: type, age and description of the equipment, manufacturer, fuel type (as applicable), year of acquisition, estimated year for replacement and other special requirements, operating costs and repair history.

Satellite entities' LTOMPs shall indicate which person or position is responsible for developing and maintaining the equipment inventory, and the process for obtaining spare parts, supplies and replacement equipment.

Chapter 8 of the 1989 Manual contains lists of equipment and materials that are commonly needed by sewer **maintenance** crews. In addition to the material and equipment listed in the 1989 Manual, it is recommended that sewer **maintenance** crews have access to metal detectors to facilitate finding buried manholes, smartphones to facilitate communication and photographing conditions, semi-permanent spot marking paint, tripod and cable on a winch for safe confined space entry, and picks or keys required to open locked manholes.

5. Sewer System Capacity Evaluation

An evaluation of the capacity of the **sanitary sewer** system may be required in either of the following situations:

- An area experiences dry weather **SSOs** and **BBs** that cannot be attributed to **maintenance** issues or deteriorated sewers; or
- An area is being developed or redeveloped and the projected dry weather flow exceeds that of the current land use.

The capacity evaluation begins with an inventory and characterization of the **sanitary sewer** system components. Most of this information should be available on the **sanitary sewer** system map.

The inventory should include the following basic information:

- Population served and service area;
- Total system size;
- Inventory of length, size, material, age and condition, if available;
- Inventory of appurtenances such as lift stations and siphons, including size, capacity, material, age and condition, if available;
- Manhole rim and inverts;
- Sewer slopes and inverts;
- Force main locations, length, size, material and condition, if available; and

- Location of laterals.

The WMO (§703) provides the standards by which **sanitary sewers** are to be sized and also establishes standards for design capacity of sanitary lift stations (§702.2.E.2). If areas within a **sanitary sewer** system lack the capacity to handle dry weather flow, according to the aforementioned WMO and TGM standards, the **satellite entity** may undertake system improvements to provide the required dry weather capacity. Such improvements require a WMO permit from the **District**.

6. Sewer System Inspection and Condition Assessment

A continuous sewer system inspection program is an important part of a preventive **maintenance** program. Inspections are required to identify and locate I/I sources, reveal blockages in the system, and to identify structural defects. Sewer defects can cause **SSOs**, **BBs**, sewer surcharging, exfiltration of wastewater into the ground, collapse of roadways and an increase of deposits in the sewers and lift stations. A continuous inspection program will identify system defects, and schedule them for repair before they cause a system failure, which would result in an emergency repair. An inspection program should include: sewers, force mains, manholes, lift stations and other appurtenances. Smoke testing and dye water testing can be used in problem areas to identify sections of the system that require detailed inspections. I/I sources can only be identified and corrected if a continuous inspection program is implemented.

Although **satellite entities**' high risk **sanitary sewers** will be inspected under the Short Term Requirements, the **LTOMP** must address inspection of the entire public **sanitary sewer** system. Classification of the entire **sanitary sewer** system, including gravity lines, manholes, lift stations, and force mains, into high-, medium-, and low-risk categories is recommended for forming the basis of establishing the frequency of sewer inspection and condition assessment. Figure 11-3 in the 1989 Manual provides recommendations for frequency of inspection based upon the characteristics of the community. **Satellite entities**' **LTOMP** must include a description of the continuous sewer system inspection program which shall detail the frequency of inspection for various portions of the **sanitary sewer** system as well as the inspection method to be used. A goal is to inspect the entire public **sanitary sewer** system on a 10-year cycle. At a minimum, two percent (2%) of the **sanitary sewer** system must be inspected each year. As discussed under the Short Term Requirements, inspections shall be conducted according to NASSCO standards, or an approved equivalent system of standards. NASSCO codes can be used to prioritize rehabilitation work.

PACP® condition ratings are meant to be objective and should be coded by trained and experienced technicians familiar with the rating system. Structural defects with a rating of 5 indicate an imminent collapse and should receive immediate attention. O&M defects commonly include root penetration, sedimentation, and buildup of fats, oils and grease (FOG). A rating of 5 indicates a significant or near-total blockage. Each pipe segment is assigned a quick rating which indicates the severity of the most significant defect on the segment as well as the overall condition of the segment.

PACP® inspection databases can be used in a GIS or CMMS to map individual defects, and full pipe segments can be thematically coded to prioritize segments for more frequent re-inspection cycles or for long term budgeting for O&M and rehabilitation.

On a long term basis, it is crucial to maintain consistency in the review and categorization of defects. To this end, it is important that **satellite entities** performing condition assessments in-house have staff available who have received proper PACP®, MACP® and LACP® training and certifications as well as training in defect coding software compatible with CMMS systems. Work contracted to others should be expected to follow the same standards for ease of integration with condition assessment data collected by others.

The **satellite entity** can utilize the NASSCO rating systems for long term O&M in the following ways:

1. Defects can be individually graded so that pipes can be prioritized based on severity and cross-referenced with criticality and consequence of failure. This results in focusing rehabilitation funds where they will have maximum impact.
2. Defect databases can be maintained and used to compare previous inspections for changes or deterioration to prioritize the frequency of re-inspections.
3. Pipe segments subject to FOG build-up can be mapped and prioritized for more frequent re-inspection and cleaning cycles.
4. Service connections can be mapped along the sewer segment minimizing excavations during future repairs.
5. Data can be used to update the GIS for material, size, and condition.

Electrical current leakage testing (currently a proprietary technology of Electro Scan, Inc.) may be used in conjunction with or as an alternative to CCTV to identify sources of infiltration or exfiltration along pipelines that may not be visible by CCTV inspection. This method can be used for pipes of any non-conductive material, and it provides a quantifiable, objective measure of a pipe’s potential for leakage. The main advantages of this technology compared to CCTV are as follows:

- Inspections and quantification of defects can be conducted more quickly than CCTV.
- Sources of infiltration that are not visible from CCTV inspection are frequently identified.
- The portion of the pipe below the flow line can be inspected more easily than with CCTV.
- Defects in lined sewers, which are often undetectable on CCTV, can be located.
- Defects are quantified by their estimated I/I contribution in units of flow.

Disadvantages, as compared to CCTV are as follows:

- Inspections do not provide a visual image of the defects.
- Defects are not coded according to PACP® condition ratings.
- The method cannot be used on metal pipes or any other conductive pipe material.

While Electro Scan does not replace CCTV as a PACP® inspection method, it can be used as a way to prioritize subsequent CCTV inspections and to supplement CCTV by identifying additional sources of leakage. The technology is also effective at certifying pipe lining by detecting small sources of leakage not visible from CCTV.

Acoustic Emissions Testing (AET) is a form of pipeline inspection that can be used to inspect force mains, siphons, or other pressure pipes that CCTV is unable to inspect. AET must be conducted while a pipe is full, allowing a pressure pipe to be tested while still in service. The SmartBall developed by Pure Technologies is one form of this technology which can inspect very long pipelines using just two points of access — one to insert the unit and one to retrieve it — by emitting acoustic signals and monitoring their activity as the inspection unit travels along the pipeline.

Another type of acoustic testing is used in gravity sewer pipes to locate potential blockages by sending an acoustic signal between manholes from the surface. The Infosense SL-RAT is one example of this technology. Compared to CCTV, it has the following advantages:

- Inspections are much faster than CCTV.
- Inspections can be conducted from the surface, reducing the need for personnel to perform confined space entry.
- The method utilizes smaller, more mobile equipment.

Limitations of the method include the following:

- Only locations of potential blockages are detected.
- CCTV is required to identify both the type and location of the blockage.
- It is more effective for smaller diameter pipes.

Although it cannot replace CCTV, acoustic testing can be a fast, low-cost method for prioritizing where to use CCTV and for locating potential blockages. It has been proven effective in reducing the risk of **SSOs** caused by reductions in pipe capacity.

Satellite entities must have a program for inspection of new **sanitary sewer** facilities, both publicly owned and privately owned. Requirements for inspection in conjunction with new construction shall be contained in **satellite entities**’ ordinances. Written procedures for the inspection of new construction, including inspection checklists, must be included in the **LTOMP**.

7. Sewer System Rehabilitation and Updating the CIP

   A sewer system rehabilitation program should be established with the objective of maintaining the conveyance capacity of the sewer system. This is accomplished by ensuring structural integrity, limiting the loss of conveyance capacity due to excessive I/I, and limiting potential **groundwater** contamination by controlling exfiltration. The rehabilitation program should be based on all recorded information from all **maintenance** and observations made as part of the capacity evaluation.

   The type of rehabilitation method depends on several pipe characteristics such as age, material, size, location, sewer flow, surface condition, severity of I/I, etc. Rehabilitation methods include replacement, lining, grouting, joint sealing, etc. The rehabilitation program should identify methods that have previously been used successfully to guide methods to be utilized for subsequent sewer rehabilitation. Chapter 6 of the 1989 Manual describes standard rehabilitation methods. In addition, the WEF Manual of Practice FD-6 contains detailed information about current rehabilitation methods.

   Rehabilitation procedures for manholes often involve modifications to covers and frames, which are common entry points for extraneous flows to the system. One such source is from manhole covers with open pick holes located in low-lying or flood-prone areas. The two references mentioned above outline several solutions that will reduce inflow from such manhole covers, which are among the least expensive ways to reduce inflow. In addition, adjustments to the manhole frame can also be completed to restore the watertight seal between the frame and the manhole. Infiltration through leaky manhole walls can be repaired by injecting chemical grouts or installing rubber joint seals at leaking manhole section joints. Manhole restoration methods include coating, patching, plugging and installing a structural lining. Figure 8.18 illustrates application of cementitious lining inside of a manhole. The method used depends on the causes of deterioration, whether the manhole is still structurally sound, and the extent of the damage. Refer to Pages 6-3 through 6-7 of the 1989 Manual for more detailed information on manhole rehabilitation.

Figure 8.18: Manhole Rehabilitation by Cementitious Lining

Rehabilitation methods for sewer pipes include open cut and trenchless methods. Many sewer pipes can be repaired from inside the pipe, but in cases of extensive structural damage, a complete replacement of the sewer pipe may be necessary. The most common rehabilitation methods for sewer pipes include:

- Cured-in-place-pipe (CIPP) lining – lining a section of pipe (usually between two manholes) by inserting a "sleeve" (usually polyester or fiberglass) that is saturated with a resin. When the sleeve is inflated with water or air, the resin is hardened using heat, which forms a liner within the existing pipe. Service connections to the pipe are re-established by cutting openings in the lining. This method cannot be used to rehabilitate pipe sections with severe deformation. Figure 8.19 shows the CIPP lining process.

Figure 8.19: Cured-in-Place Pipe (CIPP) Lining

- Sliplining - a new pipe, usually made of HDPE, is pulled into the existing sewer. With structural grouting of the annual space between the existing and new pipes, this is a structural repair. Excavation at the insertion and receiving pits is necessary, and re-establishing service laterals also requires excavation. This method reduces the inside diameter of the sewer more significantly than CIPP does.
- External grout injection – injecting chemical or cement-based grouting to stabilize soils, fill underground voids and reduce **groundwater** movement. Since the grout has to be injected exactly where known leaks exist, the external grouting method is better suited for stabilizing soils rather than sealing out infiltration.
- Internal joint sealing – the most commonly used method for sealing leaking joints in sewer pipes and involves sealing the leaking joints or cracks using a chemical grout gel. Chemical grouting can be performed for sewers flowing partially full, and maximum flow depths have been prescribed by NASSCO for effective chemical grouting.
- Point repairs - these repairs usually address a damaged section of pipe and require excavation. They may be used in conjunction with other repair methods, such as CIPP lining.
- Pipe replacement – excavation and replacement of damaged pipe. Although likely to be the most expensive option, replacement may be warranted when an increase in pipe size, change in alignment, etc. is needed in addition to the rehabilitation work.

Additional information on the methods described above can be found on pages 6-8 through 6-16 of the 1989 Manual as well as in the WEF Manual of Practice FD-6.

Because lateral connections may contain excessive defects, repairs to these service connections can also significantly reduce inflow and infiltration into the system. As outlined in Chapter 6 of the 1989 Manual (Page 6-16), there are multiple options available for rehabilitation of lateral connections: (1) variations of the standard chemical grouting method that utilize specialized television cameras, which is illustrated in Figure 8.20, (2) CIPP lining, and (3) complete replacement is also a consideration.

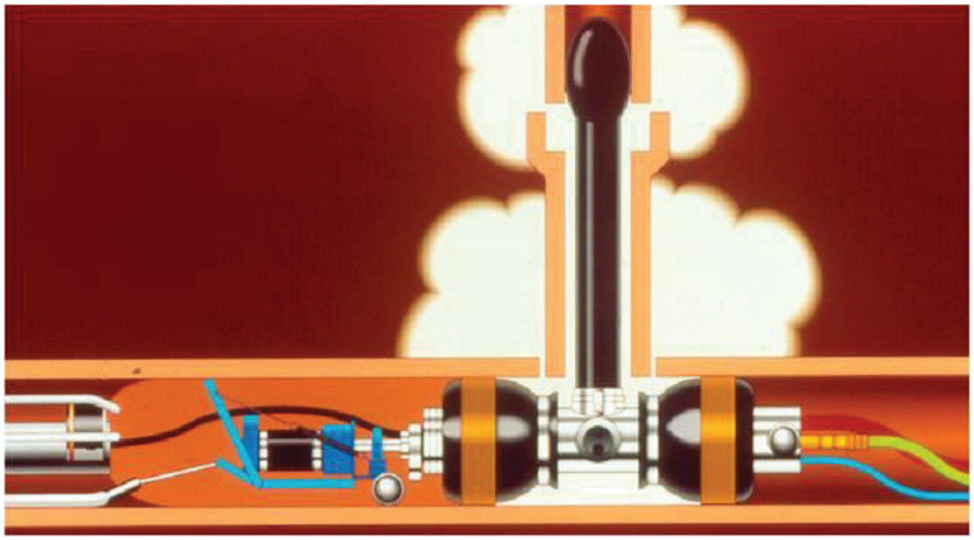


Figure 8.20. Lateral Rehabilitation by Injection Grouting

Table 6-1 on Page 6-19 of the 1989 Manual provides a summary of the most common sewer rehabilitation methods along with their associated advantages and disadvantages. In addition, Table 6-2 on Page 6-21 of the 1989 Manual provides a summary of the service lives for repairs to the sewer system.

The cost of the rehabilitation work should always be compared to the replacement cost of the system component before making a decision on which corrective measure to implement. For severely deteriorated components of the sewer system, it may be more cost-effective to perform a complete replacement instead of rehabilitation. Other items that may also factor into the decision-making process include safety, potential utility conflicts, the need to maintain existing sewage flows and traffic disruption. Prior to choosing a corrective action (rehabilitation vs. replacement), the service lives of the repairs should also be taken into consideration.

Each **satellite entity's** rehabilitation program should prioritize rehabilitation work according to severity of defects, age of the sewer, expected impact of sewer failure, anticipated public works projects in the vicinity that may provide an opportunity to perform sewer rehabilitation and available funding/resources. The **LTOMP** must include an explanation of the process used by the **satellite entity** to prioritize sewer rehabilitation projects.

Rehabilitation projects that will be performed by contractors should be included on the **satellite entity's** CIP. The CIP developed under the Short Term Requirements shall be updated as projects are completed and as new areas requiring rehabilitation are identified under the inspection program of the **LTOMP**. The CIP should include the fiscal year in which capital improvements are to be undertaken, the anticipated start date, the **District** permit number, the anticipated cost, a project description, and the priority of the project.

Completed rehabilitation work should be tracked on the **sanitary sewer** system map. Information to be included in the sewer system database includes contract number for rehabilitation work, date work was performed, rehabilitation method, and contractor.

The severity of the defects to be addressed under sewer rehabilitation efforts should be a significant factor in determining the budget necessary to support the CIP. **Satellite entities** are encouraged to allocate a portion of annual revenue for a capital improvements reserve fund so that resources are available to undertake capital improvement projects when necessary. Options for funding rehabilitation projects other than a reserve fund include assessments from a special service area and State Revolving Loan Funds.

8. Funding Plan

Satellite entities must secure a funding source to continually implement the **LTOMP**.

Funding can come from various sources, including service fees for sewer and water usage. The system owner should track all costs in order to have accurate records each time the annual operating budget is developed. An annual baseline provides documentation for future budget considerations and provides justifications for any future rate increases if they are needed.

The key components in an annual operation budget are the cost of preventive and corrective **maintenance** and major collection system repairs and improvements. There should also be an annual budget of discretionary and non-discretionary items. The annual budget should also address CIP projects, as discussed above.

Satellite entities may also utilize sources such as **IEPA** State Revolving Fund (SRF) loans or federal loan or grant programs to fund rehabilitation and repair costs. Low-income areas may be eligible for community development grants, or areas impacted adversely by flooding, particularly those served by combined sewers, may be eligible for disaster relief or green infrastructure programs. These funding sources typically require advanced planning and lead time, as well as adequate economies of scale, in order to be utilized effectively. Therefore, they are typically considered potential funding sources for preventative **maintenance** and rehabilitation, such as sewer lining or replacement and combined sewer separation, and not for emergency repairs or routine **maintenance**, such as cleaning and televising.

Categories of operating costs are labor, utilities and supplies, and outside contractors. These categories should include information on unit costs, total costs and the amount or quantities used.

The system owner should track all **maintenance** costs throughout the year, including those associated with contracted services, so that the budget is based on representative costs of the previous years. The budget should be developed by using past records that are usually categorized as preventive **maintenance**, corrective **maintenance**, projected repair requirements and actual repair requirements.

Costs for emergency repairs should be a relatively small percentage of the entire budget. Emphasis should be placed on planned **maintenance** to avoid costly emergency repairs. An emergency reserve may also be established as part of the budget. The budget should also consider including a **maintenance** work backlog. The labor portion of the budget should be consistent with local pay rates and staffing needs.

Though not a means to accomplish I/I removal, potential sources of funding for work on private service laterals are sanitary service lateral warranty insurance programs. These programs have been developed by private companies and are marketed directly to homeowners or through the local community. These private companies typically retain local plumbers and contractors to perform the covered service lateral repairs. Property owners in these programs typically will pay a monthly fee, and the insurance will cover all or most costs associated with repairing the portion of the external service lateral that is damaged, clogged with roots, collapsed, and etc. It should be noted that lateral insurance does not cover repairs to address I/I, such as the lining of laterals due to leaking joints. Only the portion of the service lateral owned and maintained by the homeowner is covered. These service lateral warranty insurance programs do not typically cover costs related to replacing trees or shrubs damaged or removed during the repair, damage from sanitary backup into the home from the main sewer, replacement of the entire lateral (unless the entire lateral is damaged) or costs above a pre-determined annual cap for all repairs.

Satellite entities’ **LTOMP** must indicate how annual operating costs, emergency repairs and capital improvements will be funded. **Satellite entities** must report their annual budget and the actual amount spent on their **LTOMP** each year to the **District**.

9. **Private Sector Program (PSP)**

As discussed earlier, all **satellite entities** must develop a **PSP** which will be implemented in conjunction with the **LTOMP**. **Satellite entities** will be required to report activities performed under the **PSP** to the **District** each year.

Entities may also wish to incorporate the inspection and repair of private service laterals with public sewer and road improvements when excavations expose or make private laterals more accessible to work crews.

Though typically more characteristic of a short term program, smoke testing can be employed as part of a long term program to determine the effectiveness of remediation of I/I sources identified during a short term program. Smoke testing can also identify private sector defects on sewer laterals, which are subject to progressive deterioration and would be more costly to individually inspect by CCTV. Smoke testing can identify which laterals need follow-up CCTV to recommend repairs.

10. Sewer Use Ordinance and Enforcement

To run an effective **sanitary sewer** operation and **maintenance** program, **satellite entities** must have the authority to do the following:

- Control the quantity and quality of wastewater from new developments and satellite collection systems;
- Control I/I sources ;
- Control sources of fats, oils and grease (FOG);
- Require proper design and construction of new and rehabilitated sewers and connections;
- Require proper installation, testing and inspection of new and rehabilitated sewers; and
- Access all components of the collection system.

This authority is commonly established by the adoption of a sewer use ordinance, though it may be established in service agreements or contracts as well, depending on the terms by which the **satellite entity** provides service to particular parties.

At a minimum, a sewer use ordinance will:

- Identify acceptable uses of the **sanitary sewer** system;
- Establish a procedure for obtaining authorization to connect to the sewer system;
- Establish enforcement measures or penalties for parties that violate the Sewer Use Ordinance;
- Describe regulations concerning industrial waste;
- Place limits on the quantity and composition of waste that is discharged to the system;
- Authorize the **satellite entity** to inspect new sewer construction; and
- Authorize the **satellite entity** to inspect private property for improper and/or illegal connections to the sewer system.

Satellite entities must have strict control over the nature and quantity of new flows introduced to their collection systems. **Satellite entities** must also establish design standards for sewer construction in both private and public sewer systems. These controls are normally implemented through a **building** permit process that involves design review and construction inspection by the **satellite entity**. Standards for new construction, procedures for reviewing designs, and protocols for testing, inspection and approvals should be established. **Satellite**

entities' standards for design and construction of sewers must comply with **IEPA** and **District** standards, at a minimum.

In preparing design standards and reviewing proposed designs, **satellite entities** should emphasize ease of **maintenance**. Construction supervision should be provided by qualified staff, preferably a **Professional Engineer**. **Satellite entities** should ensure that **building** occupancy permits are not issued until all requirements pertaining to **sanitary sewer** construction are satisfied.

Satellite entities must submit copies of their sewer use ordinance(s) with the **LTOMP**. The **LTOMP** must describe the process for updating the sewer use ordinance. It must also include information about procedures and programs that the **satellite entity** has implemented to administer the sewer use ordinance(s).

The sewer use ordinance can be enforced using various means under the authority of the **satellite entity**. Penalties for non-compliance should be explicit and implemented in a fair and consistent manner. The mechanisms for enforcement available to the **satellite entity** include:

- Fines;
- Court orders;
- Shutoff of water service;
- Refusal to grant requests for additional service(s);
- Refusal to grant **building** permits for additions or modifications to the property; and
- Refusal to approve sale or transfer of a property.

Satellite entities considering the use of penalties to private property owners for non-compliance should be diligent in vetting ordinance changes with public officials, residents and other stakeholders.

Enforcement of sewer use ordinances may require inspection of private properties to verify compliance. Private property inspections can be conducted as a targeted program by the **satellite entity** with consent of the owners of properties being inspected. Other opportunities to inspect private properties include inspections for **building** permits, property transfers or water meter **maintenance**.

11. Template **LTOMP**

    A template **LTOMP** is provided in Appendix D.

Additional Information to Support LTOMP Development and Implementation

Although not addressed specifically in Article 8 of the WMO, the following section addresses topics that are relevant to the management of **sanitary sewer** systems. In developing a comprehensive **LTOMP**, it is recommended that **satellite entities** consider addressing the topics discussed below.

Flow Monitoring

Flow monitoring provides information on dry weather flows and areas of the **sanitary sewer** system that experience wet weather flows from I/I sources. There are three types of flow monitoring techniques: permanent and long term monitoring, temporary and short term monitoring, and instantaneous monitoring. Permanent flow monitoring is performed at discharge points of the **sanitary sewer** system and lift stations. Temporary flow monitoring is typically done for 30 to 120 days and can be used to identify **sanitary sewer** subbasins with high wet weather flows and to evaluate pre- and post-rehabilitation work performance with I/I source removal. Instantaneous monitoring involves a single reading.

When a **satellite entity** decides to conduct flow monitoring, a flow metering plan should be established that describes the monitoring strategy and includes the frequency of inspection, service and calibration.

Flow metering performed for the purpose of quantifying I/I can be separated into three components: base flow, infiltration and inflow. Base flow is the flow generated by wastewater. Infiltration is the amount of **groundwater** that enters the **sanitary sewer** system through sewer defects and deficiencies. Inflow is the amount of **stormwater** runoff that enters the **sanitary sewer** system through direct connections.

For smaller **sanitary sewer** systems, where cost may prohibit the implementation of flow metering, other methods, such as a visual inspection at manholes, may be done during low-flow periods to determine if I/I flow is conveyed in the **sanitary sewer** system.

Basic procedures for conducting flow monitoring are addressed in the 1989 Manual on Pages 3-7 to 3-32. Flow monitoring programs typically fall into one of three categories:

- *Short term for the development of wet weather peaking factors*

  A reasonable relative ranking of subbasin wet weather flow response can be established with three or four storm events.
- *Short term for the development of wet weather flow/rainfall relationships*

  The correlation of peak wet weather flow response to rainfall intensity required to establish design storm peak wet weather flows and pre- and post-rehabilitation design storm peak flows typically requires at least six measurable (non-surcharging with an intensity of over 0.15 inches per hour) storms under similar medium to high antecedent moisture conditions.

- *Long term*

  Long term monitoring programs where flow meters are left in the **sanitary sewer** system are useful for tracking the reduction in wet weather flows in a multi-year investigation and rehabilitation program.

In addition to procedures in the 1989 Manual, flow monitoring must also include:

- Redundant depth sensors and a Doppler velocity sensor;
- Short term programs: Site calibration and meter **maintenance** during installation, upon removal, and on semi-weekly basis. If a meter's data is transmitted via telemetry, the frequency of these activities can be reduced.
- Long term programs: minimum of monthly calibration and site **maintenance** unless site is on data telemetry;
- Short term program monitoring interval of 15,000 to 25,000 linear feet;
- Long term monitoring interval of up to 100,000 linear feet; and
- Continuously recording rain gauge requirements of approximately one rain gauge per every eight flow meters with a minimum of two rain gauges.

Data Collection Requirements:

- Flow meters and rain gauges should log data at intervals of five minutes. If there are circumstances that necessitate extending instrument battery life, an interval of no greater than 15 minutes may be acceptable. The data logging intervals of flow meters and rain gauges should match to facilitate data analysis.
- Data shall be reviewed at least once per week during the first three weeks of installation. During this time, a minimum of two calibration readings should be taken to set data adjustment standards for the flow meters. This involves manually measuring velocity and depth at several locations within the flow profile, as shown in Figure 8.21. Crews will also make efforts to prevent sensor failure, minimize equipment **maintenance** issues, avoid excessive siltation and configure monitoring equipment to capture hydraulic variations or anomalies.
- Analyze the data to identify data gaps, hydraulic anomalies and meter performance.
- Data shall be corrected and adjusted according to field measurements, calibrations and flow balances among connecting sites.

Satellite entities should utilize GIS technology as a part of the **LTOMP**. Flow monitoring information, including installation data and all **maintenance** visits for each site, shall be delivered in a database format capable of integration into industry standard GIS systems. At a minimum, a mapping grade location for each equipment installation shall be provided and should be linked to an address (rain gauge) or manhole structure (flow meter).

If the area being monitored is sufficiently large, radar-derived rainfall data can be used to enhance the monitoring of rainfall by deriving rainfall at finer spatial resolution. NEXRAD radar data is typically used in conjunction with rain gauge data and specialized software to estimate rainfall totals at locations between gauge locations in a rain gauge network. Radar data, though not required, can lead to more accurate, localized rainfall measurements for flow meter analysis.

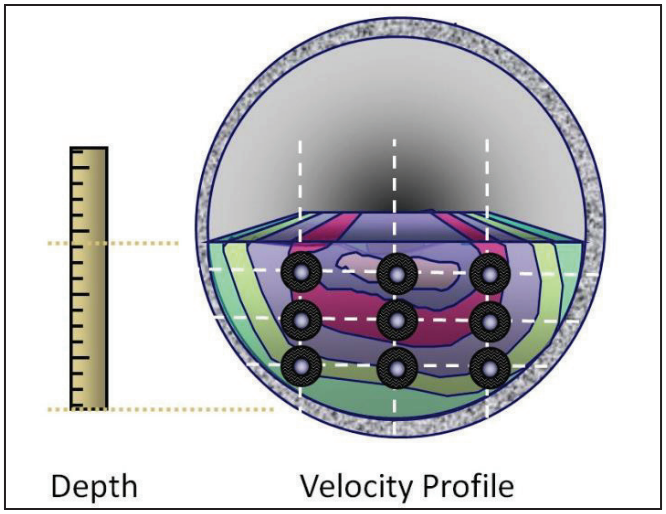


Figure 8.21. Manual Flow Meter Calibration

<u>Determination of Wet Weather Peaking Factors</u>

All **satellite entities** are required to conduct **sanitary sewer** condition assessments as part of the Short Term Requirements. In some cases, a history of reported **BB** locations and observed **SSOs** may allow for the prioritization of subareas in the **sanitary sewer** system for condition assessment activities. In many cases, however, lack of consistent reporting and recording of both **BBs** and **SSOs** will not provide enough information to prioritize subareas for condition inspection. In addition, **BBs** and **SSOs** may occur at the downstream end of the **sanitary sewer** system as a result of the total impact of all I/I defects upstream of these locations. Downstream hydraulic restrictions can also cause **BBs** and **SSOs**, which are related to system capacity more than to the level of wet weather flow. In these situations, **BB** and **SSO** history will not provide a reliable mechanism for prioritizing subareas for condition assessment.

Wet weather peaking factors generated from flow monitoring data can allow for the prioritization of **sanitary sewer** subareas for condition inspection activities. This approach can be coupled with available **BB** and **SSO** history to prioritize the subareas of the **sanitary sewer** system for condition assessment activities performed as part of the Short Term Requirements.

A flow monitoring program that is limited to the development of relative wet weather peaking factors among **sanitary sewer** subbasins can be designed with a shorter duration than a flow monitoring program designed to establish design storm peak wet weather flow rates for each subbasin. A reasonable relative ranking of subbasin wet weather flow response can be established with three or four storm events. However, the correlation of peak flow response to rainfall intensity required to establish design storm peak wet weather flows, and pre- and post-rehabilitation design storm peak flows typically requires at least six measurable (non-surcharge and over 0.15 inches per hour) storms under similar medium to high antecedent moisture conditions.

Methodology

1. Determination of Wet Weather Peaking Factors

   The wet weather peaking factor is the ratio of peak wet weather flow to average dry weather flow for all **sanitary sewer**s upstream of a flow monitoring location. A high ratio normally indicates a high concentration of high priority defects. A low ratio normally indicates a low concentration of high priority defects.

   Step 1- Determine Dry Weather Flow
   Dry weather flow can be determined from selecting the period during the flow monitoring program that is most isolated from rainfall and high **groundwater** periods. This "low flow" period should be at least one week in duration, and will in many cases include a "permanent infiltration" component. After selecting the dry weather flow period, a 24-hour diurnal flow curve can be established for each meter location. Establishing a weekend diurnal flow curve will improve the accuracy of the wet weather peaking factor determination when storm events occur on weekends. An example of a typical diurnal flow curve is shown on Figure 8.22.

   Step 2- Determine Peak Wet Weather Flow
   Peak wet weather flow after a significant storm event should be determined for all storms during the flow monitoring program. When flow monitoring is conducted with a tributary area of approximately 15,000 to 25,000 linear feet of main sewer, the sustained peak flow that occurs for 60 minutes should be selected. The 60-minute peak hourly flow is typically close to the time of concentration for subbasins of this size. Selection of average basin size smaller than this range will allow for more precise identification of subbasins with high infiltration/inflow with a proportionately higher level of effort in flow monitoring. Selection of average basin size greater than this will result in a less precise identification of subbasins with high infiltration/inflow. It is also preferable to maintain as uniform as subbasin size as possible. This will improve the ability to compare wet weather peaking factors from subbasin to subbasin while minimizing the impact of peak flow attenuation due to basin size. The longer the flow monitoring program is conducted; a larger number of storm events are likely to be monitored. This will also improve the accuracy of the wet weather peaking factor analysis.

   Storms that result in surcharging at the meter location should not be used in the peaking factor determination because the true measure of the peak flow that could be delivered to the flow meter location cannot be measured when the site surcharges. Peak wet weather flow for each storm event is then determined by subtracting the hourly diurnal dry weather flow from the storm induced peak hourly flow. An example of this determination is shown on Figure 8.23.

When pump stations are used as monitoring points instead of gravity flow meters, the most accurate method to determine peak wet weather flow requires a continuous closed pipe flow meter (either ultra-sonic/Doppler or electromagnetic) on the pump station force main coupled with continuous depth level recording in the wet well. If a force main closed pipe flow meter is not utilized, accurate timed calibration of the pump station discharge against wet well level is important. Utilization of pump station run time data only will typically underestimate peak flows.

Step 3- Determine Wet Weather Peaking Factor
Wet weather peaking factors are calculated for each storm at each flow monitoring location by dividing the peak wet weather flow by the average dry weather flow for the same time of day on the dry weather diurnal flow curve. Each flow monitoring site will then have an average wet weather peaking factor for all monitored storms. Storms with hourly intensity of less than 0.15 inches and storms that result in surcharging at a monitoring location will distort these ratios and should not be used in calculating the average wet weather peaking factor.

2. Ranking of Subbasins by Wet Weather Peaking Factors

   Subbasins can be ranked in descending order of wet weather peaking factors to establish a priority plan for sewer system condition assessment activities. An example of ranking process is shown on Figure 8.24. The subbasin ranking process can be used to prioritize subareas for condition assessment activities performed as part of the Short Term Requirements.

   In systems where it is likely to have large differences in permanent infiltration from subbasin to subbasin, or where subbasin size varies significantly, a more refined approach to determining wet weather peaking factors could be utilized. This more refined approach would involve the determination of linear feet of main sewer upstream of each flow monitoring location. Wet weather peaking factors would then be based on peak one hour wet weather flow length of main sewer (peak gpd/1,000 linear feet) and ranked in descending order.

3. Elimination of areas from Short Term Requirements condition assessment based on Wet Weather Peaking Factors

   Subbasins with very low wet weather peaking factors could be candidates for elimination from condition assessments under the Short Term Requirements and the **LTOMP**.

Additional guidance on wastewater flow components and flow monitoring planning is also available on Pages 3-1 to 3-11 of the 1989 Manual.

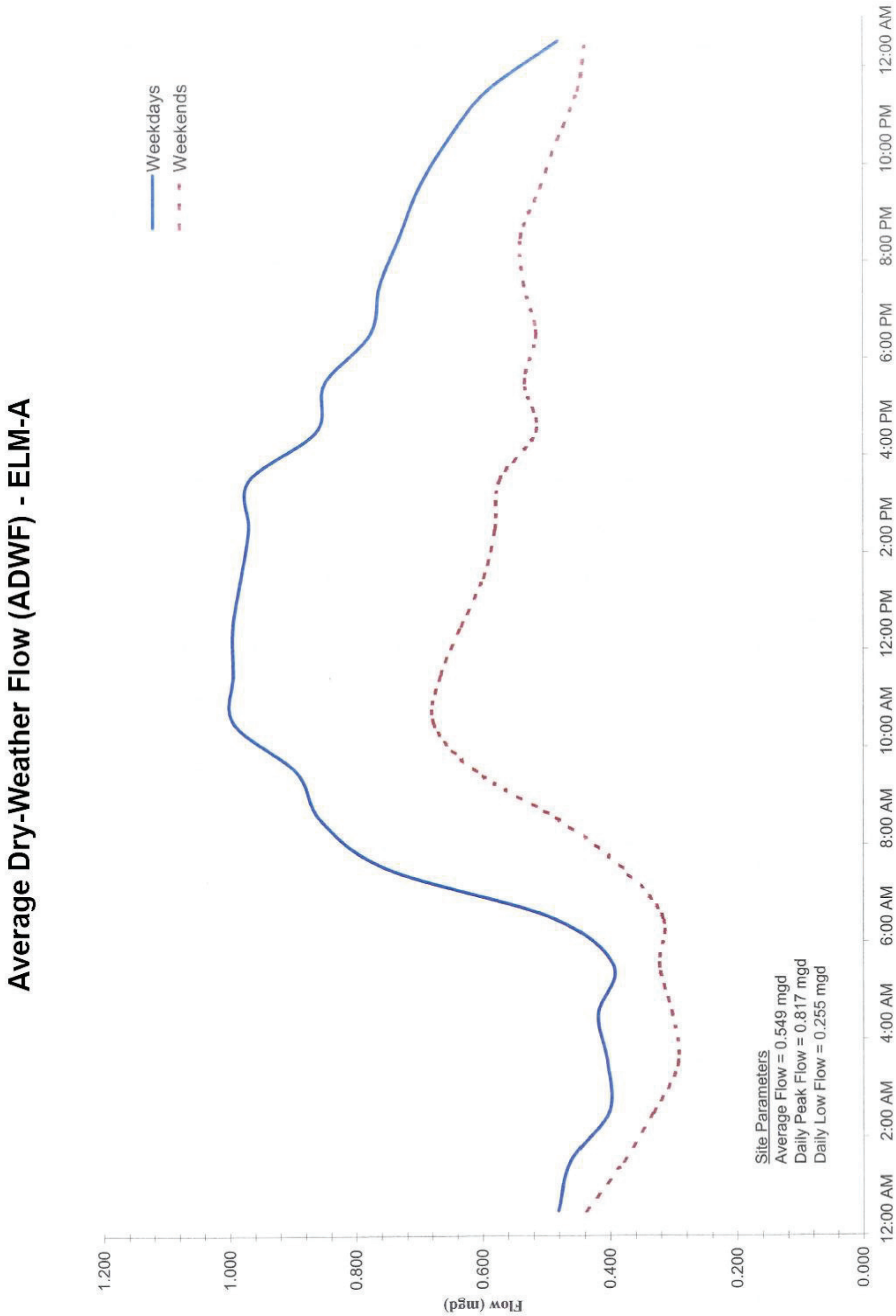


Figure 8.22. Average Dry Weather Flow

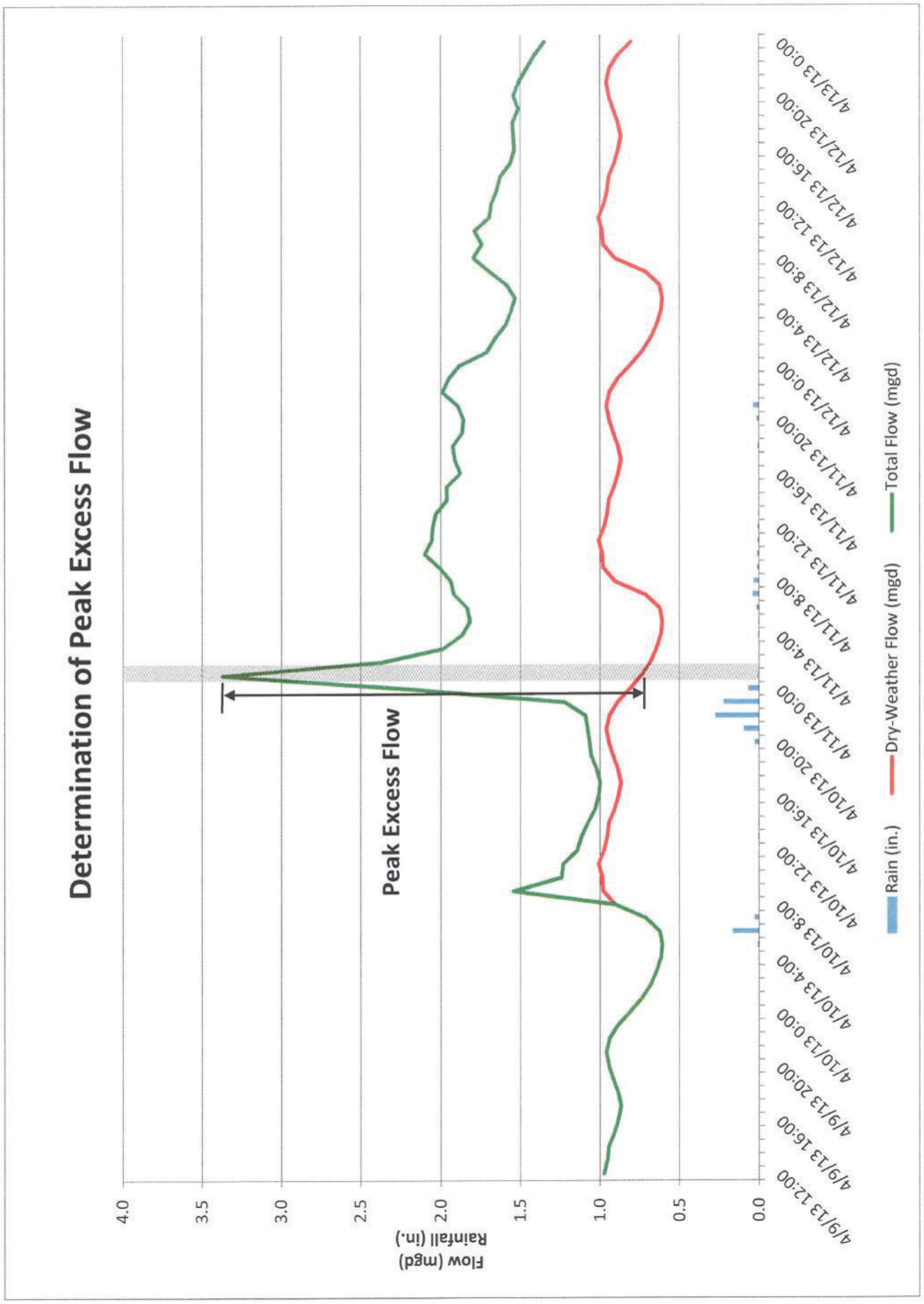


Figure 8.23. Determination of Peak Excess Flow

Typical Basin Ranking- Wet Weather Peaking Factors

Meter	Dry Weather Flow (mgd)	1-Hr Peak Flow (mgd)	Wet Weather Peaking Factor	Priority Ranking
G	0.65	19.5	30.0	1
O	0.60	17.7	29.5	2
Q	0.44	12.2	27.7	3
A	0.42	10.5	25.0	4
D	0.56	13.2	23.5	5
N	0.39	6.0	15.5	6
F	0.69	9.8	14.2	7
R	0.61	8.2	13.5	8
C	0.49	6.1	12.5	9
E	0.59	6.5	11.0	10
F	0.55	5.5	10.0	11
H	0.70	5.6	8.0	12
J	0.62	4.8	7.7	13
B	0.55	4.1	7.5	14
E	0.61	3.1	5.0	15

Figure 8.24. Typical Basin Ranking- Wet Weather Peaking Factors

<u>Local Storage Requirements</u>

In the event that a **satellite entity** has an active sewer **maintenance** program but still experiences **SSOs** and **BBs**, the **satellite entity** may consider constructing local wet weather storage facilities. The purpose of such facilities is to store excessive wet weather flow, which is later released into the **sanitary sewer** system when capacity is available. Wet weather flow that can be kept in a storage facility does not cause **BBs** or **SSOs**. Local storage facilities shall only receive wet weather flow.

Sizing of any wet weather flow facility depends upon the storage volume needed to prevent **BBs** and **SSOs** at the design wet weather event chosen by the **satellite entity**, the conditions and locations of the site of the storage facility, and the budget of the **satellite entity** for the improvement. Permits for local wet weather storage facilities must be obtained from the **District** as well as **IEPA**.

A **satellite entity** that wants to build a local storage facility should request a meeting with the **District** prior to submitting a permit application. At the meeting, the **satellite entity** should provide an analysis demonstrating the impact the local storage facility is predicted to have on reducing **BBs** and **SSOs**. If the portion of the public sewer system tributary to a local storage facility has not been classified as high risk sewer under the Short Term Requirements (prior to submitting a permit application for a local storage facility) the **satellite entity** must submit a written summary of its efforts to reduce I/I in the tributary area. This summary must include a description of public sector inspections and rehabilitation work as well as private sector inspections and corrections or improvements.

If a local storage facility is installed upstream of a lift station, the allowable rate of discharge from the lift station must be based on the dry weather flow generated by the tributary population.

Odor control measures should be considered as part of any local storage facility design. **Satellite entities** must develop a cleanup plan for any local wet weather storage facilities. Provisions for minimizing **groundwater** from flowing into storage facilities must be included in the design of such facilities. Permit application submittals for local storage facilities must include a **maintenance** and cleanup plan.

Once a local wet weather storage facility is constructed, **satellite entities** are cautioned that **SSOs** and **BBs** could still occur, depending upon the severity of wet weather events and the design capacity of the storage facility.

The **District** will consider permit applications for local storage facilities at any time during the IICP. The **District** will review Annual Summary Reports submitted under ICAP to determine whether a **satellite entity** that submits a permit application before implementing their **LTOMP** under the IICP has an active sewer **maintenance** program.

<u>Individual Backflow Prevention</u>

Another mechanism for prevention of **BBs** available to **satellite entities** and their residents is individual backflow prevention. Individual backflow prevention is any measure taken by a property owner to prevent wastewater from backing up through the lateral from the public sewer main. These measures are typically used in situations where the risk of **BBs** is atypically high, and measures to prevent **BBs** by flow reduction or public system capacity improvements is insufficient in mitigating that risk. Some examples of these situations are as follows:

- Locations where the ground profile is low relative to adjacent properties;
- Locations where the grade elevation is low relative to the invert of the public sewer;
- Properties near a lift station where the wet well level can influence the water level in upstream sewers;
- Properties with lateral connections to a large-diameter public main;
- Locations near the confluence of large diameter sewers and/or force main discharges;
- Locations near the connection to a regional interceptor that exerts downstream control on the local public sewer main; and
- Properties amid clusters of properties with large inflow sources, which collectively can overburden a small-diameter public main.

Common backflow prevention measures include the following:

- **Stand pipes and plugs.** Stand pipes and plugs are inexpensive devices inserted into a basement floor drain to prevent backflow of sewage through the drain. These devices are typically effective up to a few feet of head pressure.
- **Backwater valves.** Backwater valves are check valves that can be inserted into the private lateral at relatively low cost and ensure that wastewater can only flow out the lateral and cannot back up from the public main. However, backwater valves cannot assure outflow from the lateral to the public main in a surcharged condition. Schematic illustrations of backwater valve installations are shown in Figures 8.25 and 8.26.
- **Overhead sewer connection.** Overhead sewers are a relatively expensive modification to a property's interior plumbing that pump wastewater from basement facilities to the first floor level, allowing continued use of facilities during a surcharged condition and making a sewer backup extremely unlikely. A typical installation is shown in Figure 8.27.
- **External pump-over.** An external pump-over is an arrangement in which wastewater from the interior of a home flows into an external sump pit on the property and is then pumped into the public sewer main. These devices are very costly and require backup generators to ensure continued operation during power outages. A schematic of an external pump-over system is provided in Figure 8.28.

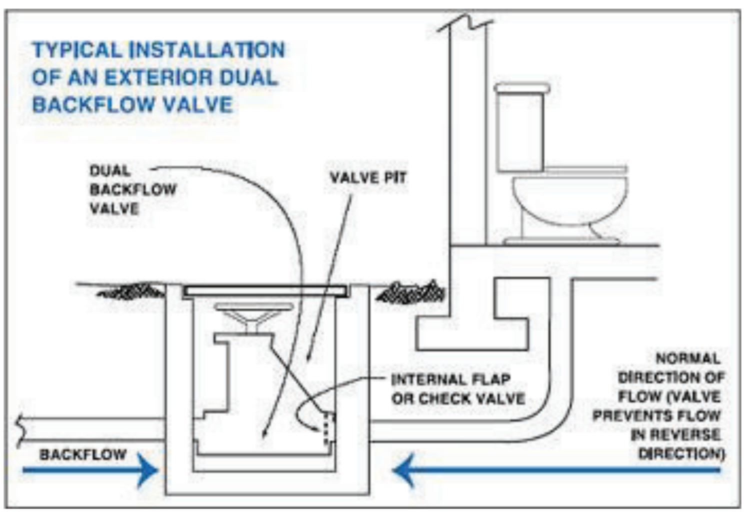


Figure 8.25. External Backflow Prevention Valve System

With any backflow prevention measure where water can be pumped into a public main, it is typical practice to require that the property owner receive a **building** permit from the public entity providing sewer services. Permit requirements help the entity maintain records of where these measures are implemented and provide a means for requiring the disconnection of private sector I/I sources (storm sumps, downspouts, and foundation drains) as a condition of granting the permit.

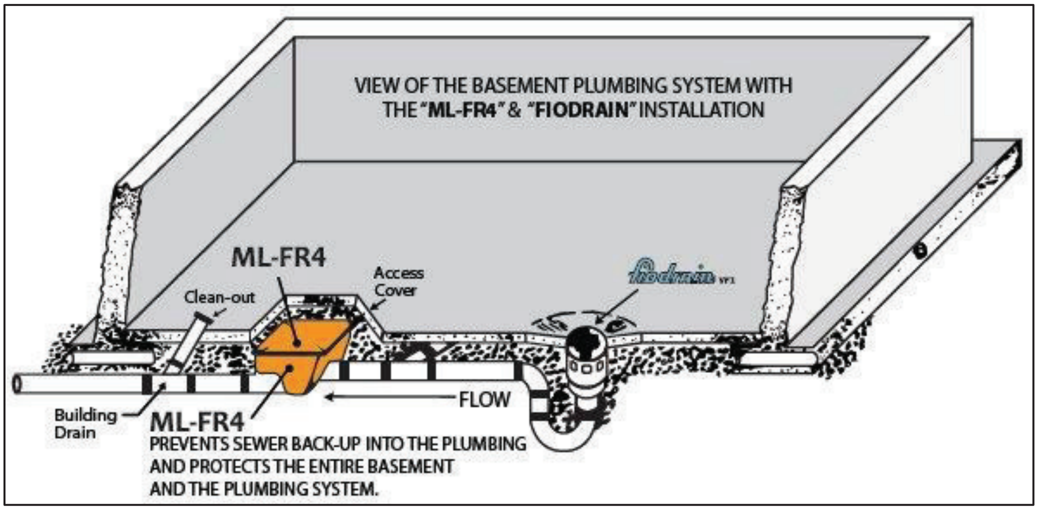


Figure 8.26. Internal Backflow Prevention Valve System

Funding of backflow prevention measures is often shared by the property owner and the public entity providing sewer services. Typical arrangements include cost-sharing programs where public funds are used to pay for a specific percentage of the improvement up to maximum dollar amount or where public funds are used to front the total cost with the property owner gradually paying back through an additional surcharge on monthly sewer service fees.

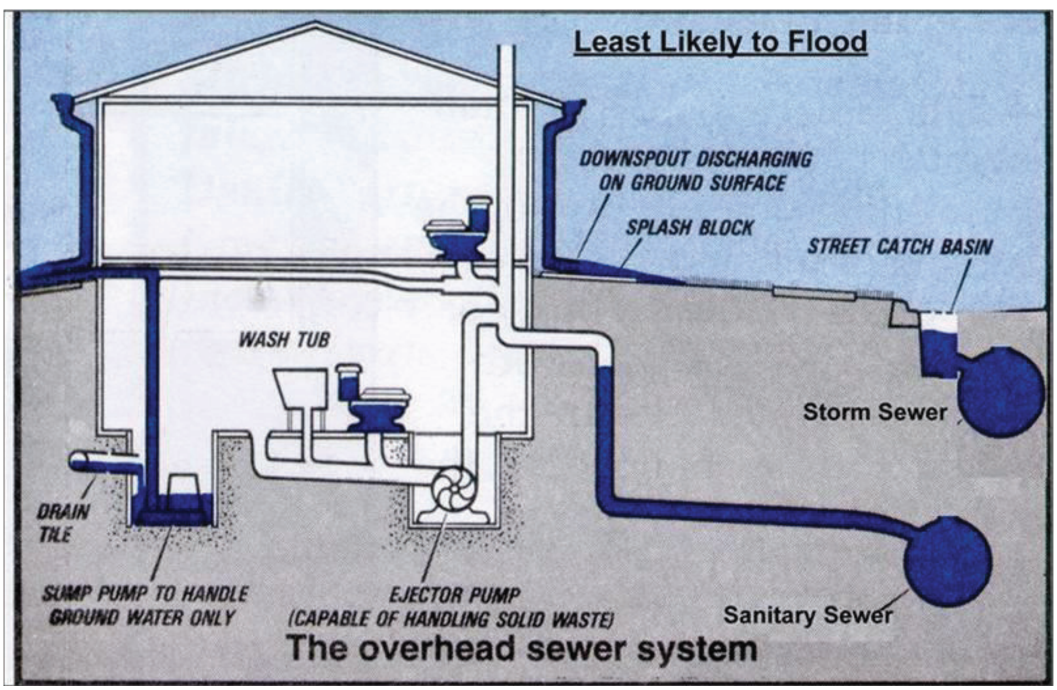


Figure 8.27. Typical Overhead Sewer System

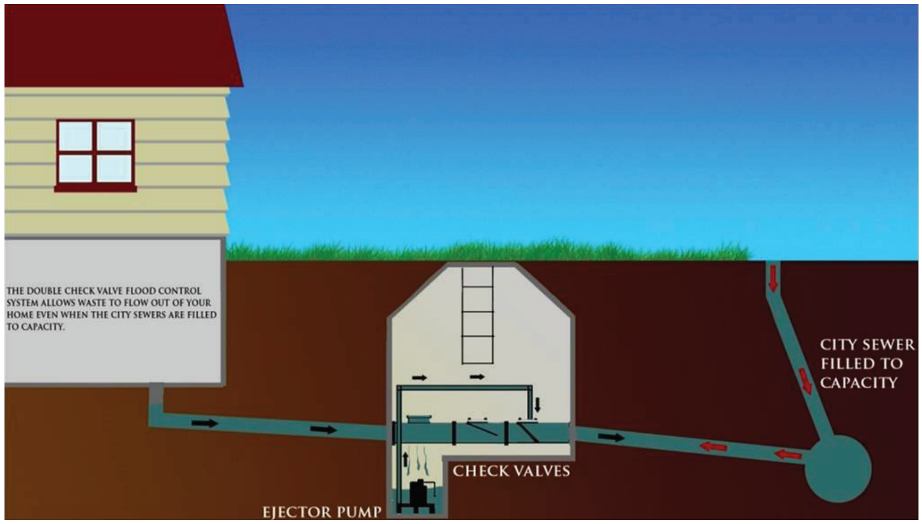


Figure 8.28. External Pump-Over System

FOG Programs

An important component of **sanitary sewer** management in most systems is a proactive, effective program to control the release of fats, oils, and greases (FOG) into the system. Due to the presence of potential contributors of significant amounts of FOG, most **satellite entities** in the **District** should have a FOG program, primarily those having food service establishments (FSEs) and large apartment **buildings**. When FOG cools, it solidifies and adheres to the inside surfaces of sewers and manholes. Over time, FOG builds up and reduces the conveyance capacity of the sewer system. FOG accumulation is a significant cause of **SSOs**, particularly dry weather **SSOs**. Therefore, preventing FOG from entering the **sanitary sewer** system is essential to maintain sewer capacity and keep sewer cleaning costs down. This is accomplished through good practices by sewer users, particularly FSEs, and through installation of grease traps and interceptors. Under the Illinois Plumbing Code, plumbing systems for institutions or commercial establishments in which grease, fats, culinary oils or similar waste products from kitchens or food processing areas are wasted - or in which grease, fats or culinary oils are wasted in connection with utensil, vat, dish or floor cleaning processes - shall include grease interceptors. All waste lines and drains carrying grease, fats or culinary oil in these establishments shall be directed to one or more interceptors. All other waste streams from such **buildings**, including discharge from dishwashing machines, must bypass grease basins or interceptors.

A sample grease interceptor is shown in Figure 8.29. Critical elements of grease interceptors include: the inlet and outlet tees - which extend below the liquid surface, cleanouts on the inlet and outlet tees, the baffle wall - which forces most of the gravity separation of sediments, water, and grease to take place on the inlet side of the basin, a manhole cover which provides access for cleaning the basin, and an opening for water to flow from the inlet side to the outlet side without overtopping the baffle.

As an alternative to grease interceptors that are part of the exterior **sanitary sewer** system, FSEs may install grease traps inside of the **building**, which are usually just above or below the floor.

A FOG program should establish legal authority, and describe the **satellite entity's** requirements for the following:

- Plan review and design standards;
- Inspections;
- Permitting and control mechanisms;
- Enforcement;
- Communication;
- Performance measures;
- Public education; and
- Information management system.

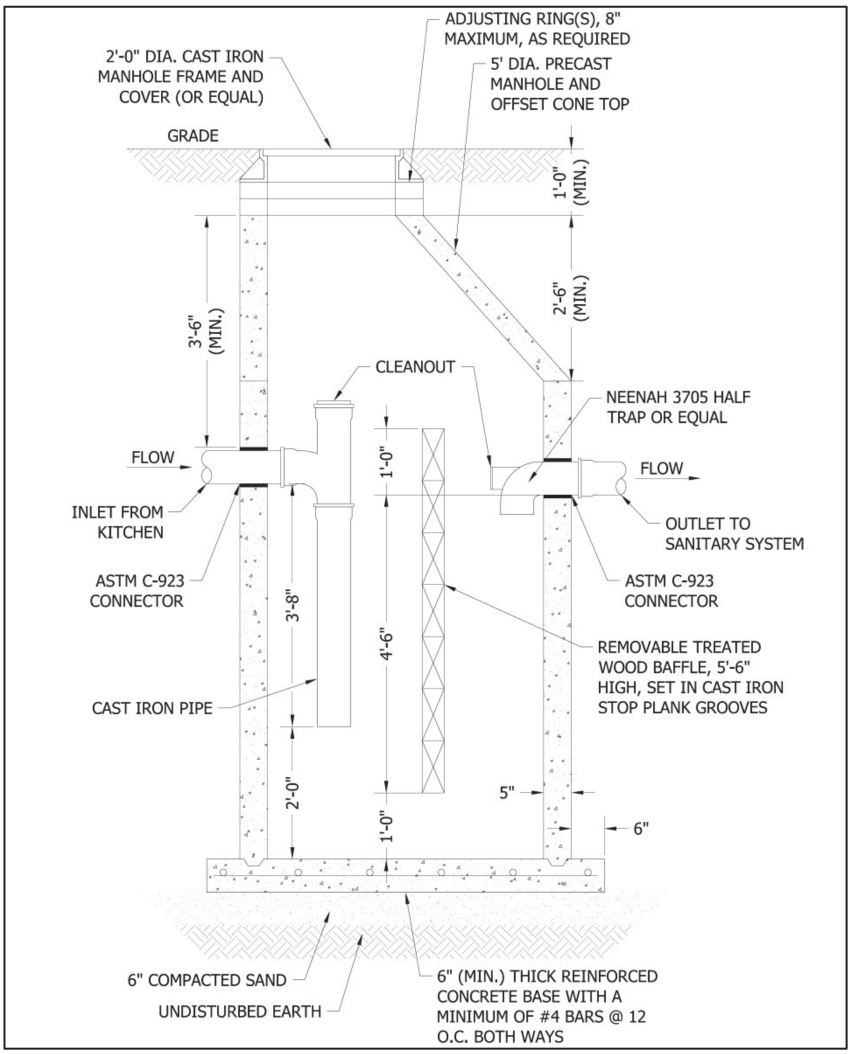


Figure 8.29. Typical Grease Interceptor (Source: Illinois Plumbing Code)

Ongoing public education efforts are necessary to ensure that residents know not to discharge FOG to plumbing fixture drains. The **District** website contains examples of municipal FOG programs.

ANNUAL REPORTING (§806)

Satellite entities must submit Annual Reports to the **District** of their progress and plans relative to their Short Term Requirements and **LTOMP**. Annual Reports must be submitted regardless of the degree of progress made during the reporting period. Depending on the manner in which deficiencies in the **sanitary sewer** system are found and addressed, additional report forms and supporting documents many need to be submitted with the annual reports. All annual reports should reference work completed within the **satellite entities**' **separate sewer area** only. Examples of completed report forms are included in Appendix D.

Annual reports must be submitted to the **District** every March 1st detailing work completed for the preceding calendar year of January 1st to December 31st. To cover the transition from ICAP to the IICP Short Term Requirements, and then to the **LTOMP**, **satellite entities** that were part of the **District** before the effective date of the IICP must submit reports according to the following schedule:

Table 8-7. Schedule for Satellite Entity Annual Reporting

Report Due Date	***Reporting Year***	***Report Form***
March 1, 2015	January 1, 2014-December 31, 2014	ICAP Annual Summary Report
March 1, 2016	January 1, 2015-December 31, 2015	Short Term Requirements Annual Summary Report, Infiltration & Inflow Control Program
Annual reports for 2016-2019 should be made using the Short Term Requirements Annual Summary Report, until the satellite entity has completed the Short Term Requirements, after which the Long Term O&M Program Annual Summary Report Form will be submitted.		
March 1, 2021	January 1, 2020-December 31, 2020	Long Term O&M Program Annual Summary Report, Infiltration & Inflow Control Program

Short Term Requirements Annual Summary Report

<u>First Full Year</u>

The first Short Term Requirements Annual Summary Report must include the following:

1. A completed *Condition Assessment Prioritization Form* as an attachment.
2. A map showing which sewers are high risk and the extent of the areas served by those sewers. This map should also show the full extent of the satellite system's service area. If condition assessment work has occurred during the reporting year, the areas where this work was conducted should also be shown on the map. Only one map needs to be submitted with the Short Term Requirements Annual Summary Report.

3. Documentation showing the location of condition assessment work on High Risk **Sanitary Sewers** performed between July 10, 2009 and July 10, 2014, if the **satellite entity** requests credit for such work. This documentation must demonstrate when the work was performed, and that the work was performed according to NASSCO standards. Documentation showing any High Priority Deficiencies identified during the condition assessment must be submitted.
4. A completed *Sanitary Sewer System Description and Inventory Form*.
5. If High Priority Deficiencies have been identified and have not been corrected during the reporting year, a *Status of High Priority Deficiencies Form* must be submitted with the Short Term Requirements Annual Summary Report.
6. If any High Priority Deficiencies have been identified but not corrected in the reporting year and are to be addressed under the Capital Improvement Plan (CIP), a CIP must be submitted with the Short Term Requirements Annual Report.

<u>Second Year through Fifth Year</u>

Subsequent Short Term Requirements Annual Summary Reports are to be submitted until the **satellite entity** has complied with the Short Term Requirements, which shall occur no later than five years after the effective date of the IICP. These Short Term Requirements Annual Summary Reports must include the following:

- An updated *Status of High Priority Deficiencies Form*;
- An updated CIP; and
- An updated sewer system map showing locations of condition assessment activities performed in the reporting year.

Long Term O&M Program Annual Summary Report

This report is to be submitted to summarize activities occurring in the year the **satellite entity** completes the Short Term Requirements. The **Long Term O&M Program** Annual Summary Reports must include the following:

1. A *Status of High Priority Deficiencies Form*, if High Priority Deficiencies have been identified but not addressed during the reporting period, and/or if High Priority Deficiencies identified in previous years have been addressed in the reporting period.
2. A CIP showing when High Priority Deficiencies will be addressed.
3. A list of property addresses where private sector I/I sources have been identified but not corrected.
4. A schedule for correcting the private sector I/I sources that have been identified but not corrected.

If a **satellite entity** undertakes any substantial sewer system improvements during the reporting period, which includes providing service to areas that were not previously served by the **satellite entity**, or full separation of a **combined sewer area**, then a revised *Sanitary Sewer System*

Description and Inventory Form must be submitted with the **Long Term O&M Program** Annual Summary Report for that year.

Item 4 of the Short Term Requirements Annual Summary Report and Item I of the **Long Term O&M Program** Annual Summary Report require summary information about **SSOs** and **BBs**. Only reportable events should be included in the total numbers of occurrences of **SSOs** and **BBs**. Reportable events include wet weather **SSOs**, dry weather **SSOs** and **BBs** caused by public sewer surcharging and blockages under either wet weather or dry weather conditions. Reportable events do not include **BBs** caused by collapse or blockage entirely of the private service lateral.

REFERENCES

Joint Committee on Administrative Rules. 2014. Administrative Rules: Chapter I, Title 77, Subchapter r, Part 890: Illinois Plumbing Code.
Available at: http://www.ilga.gov/commission/jcar/admincode/077/07700890sections.html

Monitoring and Management Services. Fats, Oils, and Grease (FOG) Management & Control Program. Available at:
http://www.waterboards.ca.gov/rwqcb7/water_issues/programs/pretreatment/docs/intro_fog_inspections.pdf

MWRD. 1989. Operations and Maintenance Manual for Separate Sanitary sewer Collection Systems for Local Agencies Tributary to the Metropolitan Sanitary District of Greater Chicago. Available at:
http://pepportal.mwrd.local:50100/irj/go/km/docs/documents/District/internet/Departments/Engineering/Doing_Business_with_Engineering/htm/Infiltration_and_Inflow/Infiltration_and_Inflow_Operations_Manual.htm

National Association of Sewer Service Companies (NASSCO). 2010. Performance Specification Guideline for Sanitary Sewer Smoke Testing, December 2010.

National Association of Sewer Service Companies (NASSCO). Pipeline Assessment and Certification Program (PACP®) Latest Version.

US Environmental Protection Agency. 2005. Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary sewer Collection Systems.
Available at: http://www.epa.gov/NPDES/pubs/cmom_guide_for_collection_systems.pdf

US Environmental Protection Agency Region 1. 2009. Template for Developing Sewer Collection System Preventive Maintenance and Sewer Overflow Response Plans; Assistance for Capacity, Management, Operations and Maintenance of your Sewer Collection System.
Available at: http://www.epa.gov/region1/SSO/toolbox.html

Water Environment Federation. 2009. Manual of Practice for Existing Sewer Evaluation and Rehabilitation No. FD-6

Water Environment Federation. 1999. Manual of Practice for Prevention and Control of Sewer System Overflows No. FD-17

ARTICLE 9: MAINTENANCE

Introduction

The WMO was established to manage and mitigate the impacts of **development** and **stormwater** upon **flooding** and water quality. The management and mitigation of these impacts is completed through an approach of effecting change on a variety of levels: from promoting responsible land use; providing storage; minimizing **impervious areas**; protecting and enhancing **wetlands**, **floodplains**, buffers, and **riparian environments**; minimizing **erosion**; and providing **sediment** control (see §103 for a complete listing). Accomplishing these goals requires implementation of onsite **maintenance** and monitoring to ensure that the work is carried out effectively over the life of the project. Through effective **maintenance** and monitoring, and completion of remedial tasks to address issues that arise, the overall goals of the program and permitted projects can be met.

Many of the **maintenance** requirements specified in the WMO are already required by **National Pollutant Discharge Elimination System** (**NPDES**) General Permits. The **erosion** and **sediment** control requirements in the WMO are generally based on the General **NPDES** Permit for **Stormwater** Discharges from Construction **Site** Activities (General **NPDES** Permit ILR-10). In addition, many of the **maintenance** requirements for each community's **stormwater** management system are covered under the General **NPDES** Permit for **Stormwater** Discharges from Small Municipal Separate **Storm Sewer** Systems (MS4 Permit).

Under the WMO (§900.1), perpetual **maintenance** plans must be prepared and implemented for the following components of every **development**:

A. **Erosion and sediment control practices**;
B. **Stormwater detention facilities**;
C. **Stormwater** collection facilities including both **major** and **minor stormwater systems;**
D. Volume control facilities;
E. **Native planting conservation areas**;
F. **Qualified sewer construction** including service on grease basins, triple basins, and private pre-treatment facilities;
G. **Wetland mitigation**; and
H. **Riparian environment mitigation**.

For every development permitted under the WMO, the facilities described in A through H above must be listed on Schedule R. In addition, the location of these facilities must be shown on Exhibit R (Recording Exhibit) along with the applicable maintenance responsibilities and activities. Two copies of Schedule R and Exhibit R should be included with each submittal and four copies of each are due at approval. Exhibit R should be submitted separately from the plans as its own sheet (minimum exhibit size of 11" by 17").

<u>Note</u>: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

Schedule R is not required for simple sewer connection permits that solely includes a straightforward service connection or private sewer extension to existing **development** (i.e. no new site development). In addition, any municipal owned properties/publicly funded permits do not require Schedule R. One exception to the above would be a permit that involves a **Sole Permittee** status (see **Sole Permitte** section in article 3 of the **TGM** for more information). If a Schedule R is not required for a publically funded school improvement project, for example, then all the appropriate **maintenance** schedules and notes must be included as part of the engineering utility or **maintenance** plan, with additional provisions for all proposed qualified sewers (if applicable) including pretreatment facilities. If a Schedule R is required for a permit, as in the case of a new volume control facility on private property, then all the qualified sewer **maintenance** including pretreatment facilities must also be included on Schedule R and Exhibit R (if applicable).

Table 9.1 lists those project types and the likely type of **maintenance** plan or native vegetation performance standards that may apply. In some cases, the **maintenance** may be a temporary measure during construction, but in most cases the **maintenance** will begin post-construction and will continue permanently with the **development**.

Table 9-1. Summary of Maintenance Plan Requirements

		Duration		Vegetative Performance Standards		Manufactured Device
		During Construction	Post Construction	Lawn, etc.	Native Plants	
A	Erosion and sediment control practices	X	X	-	-	-
B	Stormwater detention facilities	X	X	X	X	X
C	Stormwater collection facilities including both major and minor stormwater systems	X	X	X	X	X
D	Volume control facilities	-	X	X	X	X
E	Native planting conservation areas	X	X	X	X	X
F	Qualified Sewer Construction including service on grease basins, triple basins and private pre-treatment facilities	-	X	-	-	X
G	Wetland mitigation	X	X	-	X	X
H	Riparian environment mitigation	X	X	X	X	X

Plan Requirements and Guidance

The **maintenance** plan should describe inspection, **maintenance**, and monitoring activities that occur after the construction phase and continue, as applicable, into perpetuity. There are three key components to an effective **maintenance** plan:

1) A comprehensive list of all **maintenance** tasks that are to be performed for each system (A through H above) and the frequency of each task;

2) The responsible party for performing the **maintenance**; and

3) A description of applicable temporary and permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity.

Guidance for the **maintenance** of the systems listed in items A through H above is included below. Example perpetual maintenance plans and wetland mitigation maintenance and monitoring plans are included at the end of this article.

Erosion and Sediment Control Practices

All **developments** that are greater than or equal to one (1.0) acre in size must comply with the Illinois Environmental Protection (**IEPA**) **NPDES** requirements for construction activities (General **NPDES** Permit ILR-10). However, the WMO requires **erosion and sediment control practices** on all **development sites**, regardless of the area of land disturbance. For every **development**, a **maintenance** plan is required for all temporary and permanent **erosion and sediment control practices**.

The **maintenance** plan should be a schedule of implementation of the **erosion** and **sediment** control plan including, but not limited to:

A. A statement that installation of **erosion and sediment control practices** will occur prior to any soil disturbance;

B. A schedule for construction activities, including **stabilized** construction entrance installation, **sediment** trapping facility installation, **site** clearing, stockpiling, grading, construction waste disposal, temporary and permanent **stabilization**, and removal of temporary **erosion and sediment control practices**;

C. A schedule for inspection, reporting, and **maintenance** of all **erosion and sediment control practices**; and

D. Contact information for the party responsible for implementation and **maintenance** of the **site** soil **erosion** and **sediment** control plan.

Onsite inspections should be completed regularly and also after **storm events** that result in 0.5 inches or more rainfall. During these inspections, an assessment should be made on whether the onsite soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. Any **maintenance** that is required should also be identified and implemented immediately.

All **erosion and sediment control practices** should be monitored and maintained throughout the duration of construction in accordance with the requirements of §302 of the WMO and General **NPDES** Permit ILR-10. In some cases, perpetual **maintenance** and monitoring of projects, post-construction, is required to ensure the **erosion** and **sediment** control issues that may arise are quickly identified and rectified as necessary (see §310.2). However, in most cases monitoring of the **site** will cease once a Notice of Termination (NOT) has been submitted to

IEPA. All temporary **erosion and sediment control practices** should be maintained until permanent **stabilization** is achieved and then removed within 30 days of **stabilization**.

Maintenance and inspection provisions for erosion and sediment control practices during the construction phase should be provided on the plans in the form of general notes and maintenance/inspection schedules. Figures 9.1 and 9.2 provide examples of general notes for maintenance and inspections, and Figure 9.3 provides an example of an inspection and maintenance schedule.

GENERAL NOTES – MAINTENANCE

THE FOLLOWING IS A DESCRIPTION OF PROCEDURES THAT SHOULD BE USED TO MAINTAIN, IN GOOD AND EFFECTIVE OPERATION CONDITIONS, VEGETATION, EROSION AND SEDIMENT CONTROL MEASURES AND OTHER PROTECTIVE MEASURES IDENITIFED IN THIS PLAN AND STANDARD SPECIFICATIONS. ALL EROSION CONTROL MEASURES MUST BE MAINTAINED AND IMMEDIATELY REPLACED AS NEEDED AND AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL INSPECTION, MAINTENANCE, AND REPAIR. THE CONTRACTOR SHALL INSPECT AND COMPLETE MAINTENANCE OF ALL ITEMS A MINIMUM OF EVERY 7 DAYS AND WITHIN 24 HOURS OF A 0.5-INCH RAINFALL. ALL TEMPORARY EROSION AND SEDIMENT CONTROL ITEMS, INCLUDING PERIMETER EROSION BARRIER, MUST BE REMOVED WITHIN 30 DAYS AFTER FINAL STABILIZATION IS COMPLETED.

STABILIZED CONSTRUCTION ENTRANCE: THE ENTRANCES SHOULD BE MAINTAINED TO PREVENT TRACKING OF SEDIMENT ONTO PUBLIC STREETS. MAINTENANCE INCLUDES TOP DRESSING WITH ADDITIONAL STONE AND REMOVING TOP LAYERS OF STONE AND SEDIMENT. THE SEDIMENT RUN-OFF INTO THE PUBLIC RIGHT-OF-WAY SHOULD BE REMOVED IMMEDIATELY.

RIPRAP OUTLET PROTECTION: RIPRAP SHOULD BE INSPECTED FOR ANY SCOUR BENEATH THE RIPRAP OR FOR STONES THAT HAVE BEEN DISLODGED. SEDIMENT ACCUMULATION IN THE OUTFALL AREA SHOULD BE REMOVED AS NEEDED.

CONCRETE WASHOUT AREA: EXISTING AREAS SHOULD BE CLEANED OUT, OR NEW FACILITIES SHOULD BE CONSTRUCTED AND OPERATIONAL ONCE THE EXISTING WASHOUT IS 75% FULL. WASHOUT SHOULD BE INSPECTED FREQUENTLY TO ENSURE THAT PLASTIC LININGS ARE INTACTS AND SIDEWALLS HAVE NOT BEEN DAMAGED BY CONSTRUCTION ACITIVITIES. WHEN THE WASHOUT AREA IS ADJACENT TO A PAVED ROAD, THE PAVED ROAD SHOULD BE INSPECTED FOR ACCUMULATED CONCRETE WASTE. ANY ACCUMULATED CONCRETE WASTE ON THE ROAD, CURB, OR GUTTER SHOULD BE REMOVED AND PROPERLY DISPOSED.

EROSION CONTROL BLANKET: THE BLANKET AND STAPLES SHOULD BE INSPECTED FREQUENTLY AND SHALL BE INSTALLED TO THE ILLINOIS URBAN MANUAL, UNLESS OTHERWISE INSTRUCTED BY THE MANUFACTURER. EROSION OCCURRING UNDERNEATH THE BLANKET SHOULD BE BACK-FILLED AND SEEDED WITH THE APPROPRIATE SEED MIX. ADDITIONAL BMP'S MAY NEED TO BE INSTALLED TO REDUCE EROSION UNDER THE BLANKET.

SILT FENCE: SILT FENCES SHOULD BE INPSECTED REGULARLY FOR UNDERCUTTING WHERE THE FENCE MEETS THE GROUND, OVERTOPPING, AND TEARS ALONG THE LENGTH OF THE FENCE. DEFICIENCIES SHOULD BE REPAIRED IMMEDIATELY. REMOVE ACCUMULATED SEDIMENTS FROM THE FENCE BASE WHEN THE SEDIMENT REACHES ONE-HALF THE FENCE HEIGHT. DURING FINAL STABILIZATION, PROPERLY DISPOSE OF ANY SEDIMENT THAT HAS ACCUMULATED ON THE SILT FENCE. INSTANCES WHEN AREAS OF SILT FENCE CONTINUALLY FAIL, REPLACE SILT FENCE WITH ANOTHER BMP AS SEEN FIT.

CATCH BASIN AND INLET FILTERS: INLET FILTERS SHOULD BE INSPECTED FOR PROPER FILTERING, IF FILTER BAGS ARE USED, REMOVE SEDIMENT FROM THE FILTER BAGS WHEN 50% OF THE STORAGE VOLUME HAS BEEN FILLED, UNLESS OTHERWISE INSTRUCTED BY THE MANUFACTURER. REMOVE TRASH AND DEBRIS DURING INSPECTIONS. ACCUMULATED MATERIAL IN THE FILTERS SHOULD BE DISPOSED PROPERLY. DO NUT PUNCTURE HOLES IN FILTERS IF PONDING OCCURS.

THE CONTRACTOR OR CO-PERMITTEE WILL ASSUME MAINTENANCE OF FACILITIES FOR THE PROPOSED PROJECT ONCE CONSTRUCTION IS COMPLETE AND THE DISTURBED AREAS ARE STABILIZED.

Figure 9.1. Example General Notes for Maintenance of Erosion and Sediment Control Practices

GENERAL NOTES – INSPECTIONS

THE OWNER SHALL DESIGNATE A QUALIFIED PERSON TO BE RESPONSIBLE FOR SEDIMENT AND EROSION CONTROL OBSERVATION REPORTING. THIS QUAILIFIED PERSION SHALL MEET THE REQUIREMENTS NOTED IN THE ILR10 PERMIT CONDITIONS AND/OR THE WMO REGULATIONS. SITE OBSERVATIONS SHOULD OCCUR AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM THAT IS 0.5 INCHES OR GREATER, OR EQUIVALENT SNOWFALL. SITE OBSERVATION REPORTS SHOULD BE MAINTAINED ONSITE AS PART OF THE SWPPP.

EACH SITE OBSERVATION SHALL INCLUDE THE FOLLOWING COMPONENTS:

A. DISTURBED AREAS AND AREAS USED FOR THE STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION SHALL BE CHECKED FOR EVIDENCE OF, OR POTENTIAL FOR, POLLUTANTS ENTERING THE DRAINAGE SYSTEM. THE EROSION AND SEDIMENT CONTROL MEASURES IDENTIFIED IN THE PLAN SHALL BE OBSERVED TO ENSURE THAT THEY HAVE BEEN INSTALLED AND ARE OPERATING CORRECTLY. WHERE DISCHARGE POINTS ARE ACCESSIBLE, THEY SHOULD BE CHECKED TO ASCERTAIN WHETHER EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNFICANT IMPACTS TO THE RECEIVING WATERS. LOCATIONS WHERE VEHICLES ENTER AND EXIT THE SITE SHOULD BE CHECKED FOR OFF-SITE SEDIMENT TRACKING. ALL PUMPING OPERATIONS AND ALL OTHER POTENTIAL NON-STORM WATER DISCHARGES SHOULD BE OBSERVED.

B. BASED ON THE RESULTS OF THE SITE OBSERVATION, THE DESCRIPTION OF POTENTIAL POLLUTANT SOURCES IDENTIFIED, AND THE POLLUTION PREVENTION MEASURES DESCRIBED IN THIS PLAN SHALL BE REVISED AS APPROPRIATE, AS SOON AS PRACTICABLE AFTER THE OBSERVATION. THE MODIFICATIONS, IF ANY, SHALL PROVIDE FOR TIMELY IMPLEMENTATION OF ANY CHANGES TO THE PLAN WITH 7 CALENDAR DAYS FOLLOWING THE SITE OBSERVATION.

C. A REPORT SUMMARIZING THE SCOPE OF THE OBSERVATION, NAME(S) AND QUALIFICATIONS OF PERSONNEL MAKING THE OBSERVATION, THE DATE(S) OF THE OBSERVATION, MAJOR OBSERVATIONS RELATING TO THE IMPLEMENTATION OF THE STORM WATER POLLUTION PREVENTION PLAN, AND ACTIONS TAKEN IN ACCORDANCE WITH PARAGRAPH B ABOVE SHALL BE MADE AND RETAINED AS PART OF THE STORM WATER POLLUTION PREVENTION PLAN FOR AT LEAST THREE YEARS FROM THE DATE OF FINAL STABILIZATION OR PERMIT COVERAGE IS TERMINATED. THE REPORT SHALL BE SIGNED IN ACCORDANCE WITH PART VI.G (SIGNATORY REQUIREMENTS) OF THE ILR10 NPDES PERMIT.

D. THE OWNER SHALL NOTIFY THE APPROPRIATE AGENCY FIELD OPERTATIONS SECTION OFFICE BY EMAIL AT EPA.SWNONCOMP@ILLINOIS.GOV, TELEPHONE, OR FAX WITHIN 24 HOURS OF ANY INCIDENCE OF NONCOMPLIANCE FOR ANY VIOLATION OF THE STORM WATER POLLUTION PREVENTION PLAN OBSERVED DURING A SITE OBSERVATION, OR FOR VIOLATIONS OF ANY CONDITION OF THE PERMIT. THE OWNER SHALL COMPLETE AND SUBMIT WITHIN 5 DAYS OF INCIDENCE OF NONCOMPLIANCE (ION) REPORT FOR ANY VIOLATION OF THE STORM WATER POLLUTION PREVENTION PLAN OBSERVED DURING AN INSPECTION CONDUCTED. SUBMISSION SHALL BE ON FORMS PROVIDED BY THE AGENCY AND INCLUDE SPECIFIC INFORMATION ON THE CAUSE OF NONCOMPLIANCE, ACTIONS WHICH WERE TAKEN TO PREVENT ANY FURTHER CAUSES OF NONCOMPLIANCE, AND A STATEMENT DETAILING ANY ENVIRONMENTAL IMPACT, WHICH MAY HAVE RESULTED FROM THE NONCOMPLIANCE.

E. ALL REPORTS OF NONCOMPLIANCE SHALL BE SIGNED BY A RESPONSIBLE AUTHORITY AS DEFINED IN PART VI.G OF THE ILR10 NPDES PERMIT (SIGNATORY REQUIREMENTS).

F. ALL REPORTS OF NONCOMPLIANCE SHALL BE MAILED TO THE AGENCY AT THE FOLLOWING ADDRESS:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
COMPLIANCE ASSURANCE SECTION
1021 NORTH GRAND AVENUE EAST
POST OFFICE BOX 19276
SPRINGFIELD, ILLINOIS 62794-9276

Figure 9.2. Example General Notes for Inspection of Erosion and Sediment Control Practices

CONTROL MEASURE GROUP	CONTROL MEASURE	APPL.	CONTROL MEASURE CHARACTERISTICS	TEMP.	PERMNT
(*) VEGETATIVE SOIL COVER	TEMPORARY SEEDING	X	PROVIDES QUICK TEMPORARY COVER TO CONTROL EROSION WHEN PERMANENT SEEDING IS NOT DESIRED OR TIME OF YEAR IS INAPPROPRIATE.	X	
	PERMANENT SEEDING	X	PROVIDES PERMANENT VEGETATIVE COVER TO CONTROL EROSION, FILTERS SEDIMENT FROM WATER. MAY BE PART OF FINAL LANDSCAPE PLAN.		X
	DORMANT SEEDING		SAME AS PERMANENT SEEDING EXCEPT IS DONE DURING DORMANT SEASON. HIGHER RATES OF SEED APPLICATION ARE REQUIRED.	X	X
	SODDING		QUICK PERMANENT COVER TO CONTROL EROSION. QUICK WAY TO ESTABLISH VEGETATION FILTER STRIP. CAN BE USED ON STEEP SLOPES OR IN DRAINAGEWAYS WHERE SEEDING MAY BE DIFFICULT.	X	X
	PLANTS, TREES & SHRUBS		PROVIDES GROUND COVER, SHRUBS AND TREES IN ADDITION TO PERMANENT VEGETATION. MAY BE USED AS PART OF A FINAL LANDSCAPE PLAN ALONG WITH SHRUBS AND TREES.		X
NON VEGETATIVE SOIL COVER	MULCHING		ADDED INSURANCE OF A SUCCESSFUL TEMPORARY OR PERMANENT SEEDING. CONTROLS UNWANTED VEGETATION AND PRESERVES MOISTURE. PROVIDES COVER WHERE VEGETATION CANNOT BE ESTABLISHED.	X	X
	EROSION BLANKET	X	PROTECTS THE SOIL SURFACE FROM RAINDROP IMPACTS AND OVERLAND FLOW DURING THE ESTABLISHMENT OF VEGETATION. REDUCES SOIL MOISTURE LOSS DUE TO EVAPORATION.	X	X
	AGGREGATE COVER		PROVIDES SOIL COVER ON ROADS AND PARKING LOTS AND AREAS WHERE VEGETATION CANNOT BE ESTABLISHED. PREVENTS MUD FROM BEING PICKED UP AND TRANSPORTED OFF-SITE.	X	X
	PAVING	X	PROVIDES PERMANENT COVER ON PARKING LOTS AND ROADS OR OTHER AREAS WHERE VEGETATION CANNOT BE ESTABLISHED.		X
DIVERSIONS	RIDGE DIVERSION		TYPICALLY USED ABOVE SLOPES. USED WHERE AN EXCESS OF SOIL IS AVAILABLE.	X	X
	CHANNEL DIVERSION		TYPICALLY USED AT TOP OR BASE OF SLOPES. USED WHEN EXCESS SOIL IS NOT AVAILABLE.	X	X
	COMBINATION DIVERSION		TYPICALLY USED ANYWHERE ON A SLOPE. SOIL TAKEN OUT OF CHANNEL IS USED TO BUILD THE RIDGE.	X	X
	CURB AND GUTTER		SPECIAL CASE OF DIVERSION USED IN CONJUNCTION WITH A STREET TO DIVERT WATER FROM AN AREA NEEDING PROTECTION.		X
	BENCHES		SPECIAL CASE OF DIVERSION CONSTRUCTED WHEN WORKING ON CUT SLOPES TO SHORTEN LENGTH OF SLOPE AND ADD SLOPE STABILITY.	X	X
WATERWAYS	BARE CHANNEL	X	PROVIDES MEANS OF CONVEYING RUNOFF TO DESIRED LOCATION. MAY BE USED TO DRAIN DEPRESSIONAL AREAS. ONLY APPLICABLE WHEN VELOCITY OF FLOW IS VERY LOW.	X	
	STRUCTURAL STREAMBANK STABILIZATION		PROTECTS STREAMBANKS FROM EROSIVE FORCE OF FLOWING WATER		X
	VEGETATIVE CHANNEL		PROVIDED ADDED STABILITY TO CHANNEL. USED WHEN VELOCITY OF FLOW IS NOT EXTREMELY FAST.	X	X
	VEGETATIVE STREAMBANK STABILIZATION		PROTECTS STREAMBANKS FROM THE EROSIVE FORCE OF FLOWING WATER AND PROVIDES NATURAL, PLEASING APPEARANCE		X
	LINED CHANNEL		USED WHEN VEGETATION WILL NOT PROTECT THE CHANNEL AGAINST HIGH VELOCITIES OF FLOW OR WHERE VEGETATION CANNOT BE ESTABLISHED.	X	X
ENCLOSED DRAINAGE	STORM SEWER	X	CAN BE USED TO CONVEY SEDIMENT LADEN WATER TO SEDIMENT BASIN OR IN CONJUNCTION WITH A WATERWAY.		X
	UNDERDRAIN		USED TO LOWER WATER TABLE AND INTERCEPT GROUNDWATER FOR BETTER VEGETATION GROWTH AND SLOPE STABILITY. USED TO CARRY BASE FLOW IN WATERWAYS AND TO DEWATER SEDIMENT BASINS.	X	X
SPILLWAYS	STRAIGHT PIPE SPILLWAY		USED FOR RELATIVELY SMALL VERTICAL DROPS AND SMALL FLOWS OF WATER.		X
	DROP INLET PIPE SPILLWAY		SAME AS PIPE SPILLWAY EXCEPT LARGER FLOWS AND LARGE VERTICAL DROPS CAN BE ACCOMMODATED.		X
	WEIR SPILLWAY		USED FOR RELATIVELY SMALL VERTICAL DROPS AND FLOWS MUCH GREATER THAN PIPE STRUCTURES.	X	X
	BOX INLET WEIR SPILLWAY		SAME AS WEIR SPILLWAY EXCEPT LARGER FLOWS CAN BE ACCOMMODATED BECAUSE OF LOWER WEIR LENGTH.	X	X
OUTLETS	LINED APRON		PROTECTS DOWNSTREAM CHANNEL FROM HIGH VELOCITY OF FLOW DISCHARGING FROM STRUCTURES.	X	X
SEDIMENT BASINS	EMBANKMENT SEDIMENT BASIN		USED WHERE TOPOGRAPHY LENDS ITSELF TO CONSTRUCTING A DAM AND EARTH FILL IS AVAILABLE.	X	X
	EXCAVATED SEDIMENT BASIN		USED WHERE EMBANKMENT COULD CAUSE A HAZARD DOWNSTREAM IN CASE OF FAILURE AND WHEN EXCESS EARTH FILL IS NOT AVAILABLE.	X	X
	COMBINATION SEDIMENT BASIN		USED WHEN TOPOGRAPHY IS SUITABLE BUT ADDITIONAL CAPACITY IS NEEDED.	X	X
SEDIMENT FILTERS	BARRIER FILTER		USED FOR SINGLE LOTS OR DRAINAGE AREAS LESS THAN 1/2 ACRE TO FILTER SEDIMENT FROM RUNOFF.	X	
	VEGETATIVE FILTER	X	USED ALONG DRAINAGEWAYS OR PROPERTY LINES TO FILTER SEDIMENT FROM RUNOFF. SIZE MUST BE INCREASED IN PROPORTION TO DRAINAGE AREA.	X	X
	FILTER FABRIC	X	USED FOR ROADWAY CURB INLETS.	X	X
MUD AND DUST CONTROL	STABILIZED CONST. ENTRANCE	X	PREVENT MUD FROM BEING PICKED UP AND CARRIED OFF-SITE.	X	X
	DUST AND TRAFFIC CONTROL		PREVENTS DUST FROM LEAVING CONSTRUCTION SITE.	X	X

(*) EROSION CONTROL BLANKET SHALL BE PLACED ON ALL DISTURBED AREAS WITHIN 15 DAYS AFTER FINAL GRADE IS REACHED.

INSPECTION AND MAINTENANCE SCHEDULE

ACTIVITY	RESPONSIBLE PARTY	DURATION
STABILIZATION DURING CONSTRUCTION MAINTENANCE	CONTRACTOR	DECEMBER 2005 TO JUNE 2006
STABILIZATION DURING CONSTRUCTION-OBSERVATION	ENGINEER	WEEKLY AND AFTER EACH SIGNIFICANT RAINFALL EVENT
VEGETATION MAINTENANCE	CONTRACTOR	1 YEAR FROM COMPLETION
VEGETATION AND STABILIZATION MAINTENANCE	CONTRACTOR	ONGOING FROM CONSTRUCTION COMPLETION

SOIL PROTECTION SCHEDULE

STABILIZATION TYPE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
PERMANENT SEEDING	←	—	—	—	—	→						←→

PROPOSED SCHEDULE

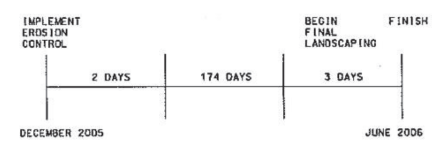


Figure 9.3. Example Maintenance and Inspection Schedule for Erosion and Sediment Control Practices

<u>Stormwater Detention Facilities</u>

A scheduled perpetual **maintenance** plan is required for all **stormwater detention facilities**, and should include, at a minimum, the following items:

- Planned **maintenance** tasks and frequency of each task such as removal of **sediment**, debris, mowing and pruning of vegetation, and restoration of eroded areas;
- Identification of the responsible parties for performing the **maintenance** tasks; and
- A description of applicable temporary and permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity.

Maintenance tasks for **stormwater detention facilities** should be performed monthly, at a minimum. The **maintenance** plan for **stormwater detention facilities** should include the following tasks:

- *Debris removal.* Trash, brush, grass clippings, **sediment**, and other debris should be removed from the **detention facility** to maintain the designed storage volume. To prevent clogging, the outlet control **structure** should also be inspected and all debris should be removed.
- *Restoration of eroded areas.* For areas where there is evidence of **erosion**, or in areas where future **erosion** is likely, protection should be provided to prevent further damage. All bare areas should be seeded and restored. Areas located along the side slopes of the **detention facility** will require seeding in conjunction with an **erosion** control blanket.
- *Vegetation control.* If used as a recreational area, the grassed areas of the **detention facility** should be mowed regularly to provide the intended use of the area. Grass clippings from mowing activities should always be collected. Mechanical methods for controlling weeds should be used instead of herbicides and pesticides. In addition, trees should not be allowed to grow along the emergency overflow weir and on any berms that are greater than four feet high. Vegetative control for **detention facilities** that serve as a **wetland** or wildlife habitat area should follow the guidance contained in the **wetland maintenance** plan.

<u>Stormwater Collection Facilities</u>

A perpetual **maintenance** plan for **stormwater facilities** is required. This includes the **major** and **minor** components of the **stormwater system** (other than the **detention facility**), such as **storm sewers**, catch basins, inlets, **outfalls** to **waterways**, and overland flow routes. A scheduled perpetual **maintenance** plan is required for all **stormwater** collection facilities, and should include, at a minimum, the following items:

- Planned **maintenance** tasks and frequency of each task such as removal of **sediment**, debris, mowing and pruning of vegetation, and restoration of eroded areas;
- Identification of the responsible parties for performing the **maintenance** tasks; and
- A description of applicable temporary and permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity.

To ensure that **stormwater** collection facilities function as they were designed, regular inspections and **maintenance** of the system should be performed every two weeks. At a minimum, the following **maintenance activities** should be performed:

- *Debris removal.* Trash, wood chips, grass clippings, **sediment**, and other debris should be removed from the catch basins, inlets, **outfalls**, and **storm sewers** to prevent clogging. Cleaning should be done in such a way that the debris is not discharged back into the **stormwater** system.
- *Removal of obstructions.* Inspections should be performed to ensure that all overland flow routes are free from obstructions. If an obstruction has been placed in an overland flow route, it should be removed immediately.
- *Vegetation control.* For grassed swales that serve as overland flow routes, regular mowing should be performed to keep grass at an optimum height (less than six inches). Trees, bushes, and any other non-grass vegetation should be removed to preserve the conveyance capacity of the swale. Any areas of bare soil should be restored immediately using seeding with **erosion** control blanket.

<u>Volume Control Facilities</u>
A perpetual **maintenance** plan for volume control facilities is required. The written plan must include:

- Planned **maintenance** tasks and frequency of each task such as removal of **sediment**, debris, mowing and pruning of vegetation, and restoration of eroded areas;
- Identification of the responsible parties for performing the **maintenance** tasks; and
- A description of applicable temporary and permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity.

Because every **development** permitted under the WMO is required to incorporate **green infrastructure** into the **site** design, special **maintenance** practices should be developed that ensure that the **green infrastructure** (both **volume control practices** and **flow-through practices**) functions properly over time. For **volume control practices**, monitoring wells are required for every 40,000 ft^2 of surface area. The monitoring wells should be utilized to determine the water level in the **volume control practice** and verify it is functioning properly.

Without proper **maintenance**, the void spaces in porous pavement and infiltration basins may become clogged with **sediment**, reducing their effectiveness. To prevent clogging in the void space of pervious pavement (concrete, asphalt, pavers), it is recommended that adjacent landscaped areas be designed such that **stormwater runoff** from these areas onto the porous pavement is minimized. In addition, low pressure power washing and vacuuming of the surface is recommended on a yearly basis. This **maintenance** is especially critical during the fall. High pressure washing should be avoided for these types of surfaces, as it can cause damage to the pavement. Proper **maintenance** is especially difficult for pervious pavers, because extra care must be taken so that power washing and vacuuming does not dislodge the small chips that are used to fill in the paver gaps. In addition, small debris can collect in the paver gaps and lead to weed growth.

For infiltration trenches and basins, the use of a mulch layer above the infiltration practice will work like a filter for the **sediment** transported by **stormwater runoff**. The mulch layer will need to be replaced when it is filled, but will protect the void spaces in the soil and aggregate layers below from **sedimentation**. An alternative to using a mulch layer is the installation of a **sediment** trap upstream of the infiltration area. The **sediment** trap is a small depression that captures **stormwater** and allows the **sediment** to settle before it reaches the infiltration basin. For the **sediment** trap to be effective, the collected **sediment** must be removed regularly.

For mechanical **flow-through practices**, such as an oil and grit separator, an effective **maintenance** plan is based on performing frequent inspections. The rate at which these devices collect pollutants will vary from **site** to **site**, and therefore frequent inspections (once per month) should be performed to ensure the system is functioning properly. The **maintenance** for these devices should be performed in accordance with the manufacturer's recommendations. As an example, the inspection and **maintenance** guide for the CDS system, which was developed by Contech Construction Products, Inc., is available on-line at:

http://www.conteches.com/products/stormwater-management/treatment/cds.aspx#1822141-technical-info

Qualified Sewer Construction

A perpetual **maintenance** plan is required for all **qualified sewer construction**. The written plan must include, at a minimum:

- Planned **maintenance** tasks and frequency of each task for the removal of objectionable wastes, fats, oils and grease, or any **other wastes** collected in private pre-treatment or separator **structures**;
- Planned routine **maintenance** for all private lift station and pumping facilities;
- Operation **maintenance** agreements for all private **service sewers** providing service to multiple **owners**;

- A description of applicable temporary and permanent access and **maintenance** easements granted or dedicated to, and accepted by, a governmental entity.

The **maintenance** for **sanitary sewer** systems should follow the guidance provided in document, Separate **Sanitary Sewer** Collection System Operation and **Maintenance** Manual for Local Agencies Tributary to the Metropolitan Sanitary **District** of Greater Chicago. This operation and **maintenance** guide was developed by Metcalf and Eddy, Inc. in 1989 on behalf of the **District** and is available on-line through the **District's** website at:

https://www.mwrd.org/irj/portal/anonymous/Infiltration

Private pre-treatment and separator **structures** that collect objectionable wastes, fats, oils and grease, or any other undesirable waste should be inspected and, if necessary, maintained every two weeks. **Maintenance** of these **structures** is usually performed by permitted haulers or recyclers, and consists of removing the material and then disposing of the material in accordance with local, State, and Federal laws.

To prevent stoppages in gravity sewers, sewer cleaning should be performed on a preventative basis. A regular cleaning schedule for sewers should be developed such that 100% of the pipes are cleaned annually. Some pipe sections may be prone to stoppages and may require more frequent cleaning, such as every month. Other pipe sections may not be susceptible to stoppages and therefore can be cleaned annually. The cleaning schedule should be customized based on information obtained during regular inspections of the system. When cleaning the sewer system, there are both hydraulic cleaning methods and mechanical cleaning methods available. Hydraulic methods utilize high-velocity water to clean the bottoms and walls of the pipes, whereas mechanical methods use equipment to physically remove the material from the bottoms and walls of the pipes.

Planned routine **maintenance** for all private lift station and pumping facilities should be based on the manufacturer's recommendations. The schedule of **maintenance activities** can be supplemented by information obtained during the regular inspections of the equipment. At a minimum, the **maintenance activities** and frequency should meet the manufacturer's recommendations.

Wetland Mitigation and Native Planting Conservation Areas

Maintenance plans must be prepared for **wetland mitigation** and **native planting conservation areas**. The plans shall cover the short term and long term (perpetual) **maintenance**. The short term plans will have set time frames based on the following examples. Actual timeframes will vary based on the complexity or difficulty of the project. The timeframes set a project length of the program; however, failure to meet the performance standards listed in the plan can extend the period until the project is approved. Long term plans are perpetual and intended to maintain the level of quality achieved during the short term period.

Short Term **Maintenance** Plan Example Timeframes:

- Temporary Impact Minimal Restoration, e.g. utility line installation - 1 year
- Enhancement/restoration of an existing area (more than minimal) - 3 years
- **Wetland Mitigation** - 5 years

The contents of the Short Term Plan are as follows:

- Proposed **wetland hydrology** and an inundation and duration analysis;
- Proposed soils and soil management activities;
- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details;
- Proposed **maintenance** and monitoring plan with **maintenance activities** and performance criteria outlined;
- Schedule of earthwork, planting, monitoring, and **maintenance**; and
- A description of applicable temporary and permanent access and **maintenance** and conservation easements granted or dedicated to and accepted by a governmental entity.

The contents of the Long Term Plan are as follows:

- A plan for the continued management, operation, and **maintenance** of the **wetland mitigation** measures including the designation of funding sources and the **person** responsible for long-term operation and **maintenance**.

<u>Riparian Environment Mitigation</u>
Maintenance plans must be prepared for **riparian environments**. The plans shall cover the short term and long term (perpetual) **maintenance**. The short term plans will have set time frames based on the following examples. Actual timeframes will vary based on the complexity or difficulty of the project. The timeframes set a project length of the program; however failure to meet the performance standards listed in the plan can extend the period until the project is approved. Long Term plans are perpetual and intended to maintain the level of quality achieved during the short term period.

Short Term **Maintenance** Plan Example Timeframes:

- Temporary Impact Minimal Restoration, e.g. utility line installation - 1 year
- Mitigation/Enhancement/Restoration of an existing **riparian environment** - 3 years

The contents of the **Riparian** Short Term Plan are as follows:

- Proposed **wetland hydrology** and an inundation and duration analysis;
- Proposed soils and soil management activities;
- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details;
- Proposed **maintenance** and monitoring plan with **maintenance activities** and performance criteria outlined;
- Schedule of earthwork, planting, monitoring, and **maintenance**;

- A plan for the continued management, operation, and **maintenance** of the **wetland mitigation** measures including the designation of funding sources and the **person** responsible for long-term operation and **maintenance**.

As applicable, the following shall also be included in the **maintenance** plan discussion.

- A description of applicable temporary and permanent access and **maintenance** and conservation easements granted or dedicated to and accepted by a governmental entity;
- The proposed naturalizing methods, such as meandering, pools, or riffles for relocated channels. Methods proposed are expected to be able to withstand all events up to the **base flood** without increased **erosion**;
- The methods by which the normal flow within the channel will be diverted to construct the new or relocated channel;
- The **erosion and sediment control practices** to be implemented;
- The appropriate hydrologic and hydraulic methods analyzing the impacts on **flood** flows and **flood** elevations (to be provided in the **floodplain** and **floodway** submittal) meeting all other requirements in the **Ordinance**, including the **floodplain** and **floodway** requirements outlined in §601 and §602 of the **Ordinance**;
- Proposed planting zones, species, quantities, sizes, locations, specifications, methodologies, and details;
- Scheduling of earthwork, planting, **maintenance**, and monitoring; and
- A description of applicable temporary and permanent access and **maintenance** and conservation easements granted or dedicated to, and accepted by, a governmental entity.

Wetland, Buffer, Riparian, and Native Planted Areas Maintenance & Monitoring Plan Format

The WMO describes within §310 (**Maintenance** and Monitoring Plan Submittal) the required contents of the submittals for each of the **site** elements listed above. However, the WMO does not provide any specific guidance or criteria regarding performance standards or format of the document. Recommendations regarding the type of **maintenance** and monitoring plan to prepare and recommended performance standards regarding certain project elements are described below.

It is recommended that **maintenance** and monitoring plans be prepared following Adaptive Management Principles. **Maintenance** and monitoring plans will be tailored to suit the needs of each **development**. Applicants will be required to determine the applicability of each element and complete the required **maintenance** and monitoring in accordance with the approved plan.

Adaptive Management is a **structured** approach for addressing uncertainties by adjusting implementation, as necessary, to improve the probability of success. Adaptive management is seen as an evolving process involving learning (the accumulation of understanding over time) and adaptation (the adjustment of management over time). The sequential cycle of learning and adaptation leads naturally to two beneficial consequences:

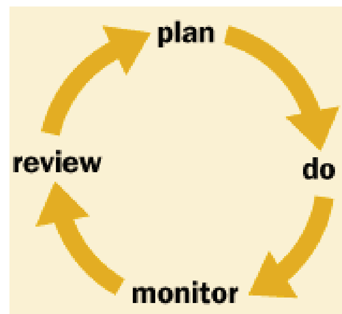
1. Better understanding of the resource system being managed, and

2. Better management based on that understanding.

<u>Adaptive Management Goals and Objectives</u>

Plans are designed to be adaptive to changing **site** conditions observed through periodic monitoring of the **site**. The monitoring visits are important to determine the annual tasks needed. Those tasks are then completed and evaluated for effectiveness. New tasks are then defined as necessary to achieve the project goals and objectives.

Plan:



- Identify management issues (e.g. weed infestations)
- Identify management goals (e.g. weeds managed, native seeding);
- Determine management strategies available (e.g. herbicide, hand pulling, burning);
- Select appropriate management action (e.g. hand removal);
- Determine what will be monitored and how (e.g. establish a fixed point in field); and
- Determine how change and success will be evaluated (e.g. absence of weeds one month or one year after removal).

Do:

- Carry out action (e.g. remove weeds, complete prescribed burn).

Monitor:

- Monitor results (e.g. revisit **site** to determine success of activities).

Review:

- Assess previous management strategy and modify plan as necessary to adapt to current **site** conditions; and
- Return to Planning – begin again, adapt to new **site** conditions.

<u>Recommended Native Seeding Planting Performance Standards</u>

For **wetland**, **riparian**, buffer, and **stormwater** areas proposed to contain native seeding or planting, the following minimum performance standards shall apply. Applicants may offer alternative standards for unique situations.

1. For projects which have or will receive a permit from the **US Army Corps of Engineers** (**Corps**), applicants should follow the most current version of the <u>*Chicago **District Permittee** Responsible Mitigation Requirements*</u> to the mitigation areas for **wetland**, buffer, and **riparian environments**. The guide is available on-line through the **Corps** website at:

http://www.lrc.usace.army.mil/Missions/Regulatory/MitigationRequirements.aspx

2. For projects that do not have to receive a **Corps** permit, applicants should at a minimum achieve the following standard:

   - At least 80% of the vegetation present within the planted **wetland** and buffer restoration area shall be native, non-invasive species. This standard does not apply to emergent communities or existing previously vegetated areas that are not undergoing restoration or are lawn.

Maintenance Plan Implementation

As specified in the WMO (§900.4), **maintenance** is the responsibility of the **co-permittee** and **permittee** of the **development**. The **maintenance** responsibility may be delegated to an entity that is acceptable to the **permittee**, however, ultimate responsibility for the **maintenance** of the facilities lies with the **permittee**.

Maintenance plans may be modified if **site** conditions change or issues arise, however, the **District** or **authorized municipality** has discretion as to whether or not to accept the requested modification.

EXAMPLE MAINTENANCE PLAN FOR EXHIBIT R (RECORDING EXHIBIT)

The Owner of the XYZ Development, with facilities as shown on Exhibit R, shall assume responsibility for the following perpetual maintenance activities:

1. General

Regular inspections and routine maintenance of general areas shall be performed on a monthly or as-needed basis. Specific items of concern include:

____ Litter and debris shall be controlled
____ Landscaped areas shall be maintained with regular mowing and restored with appropriate seeding/vegetation as necessary
____ Accumulated sediment shall be disposed of properly, along with any wastes generated during maintenance operations
____ Riprap areas shall be repaired with the addition of new riprap, as necessary, of similar size and shape
____ Roads shall be swept, vacuumed and/or washed on a regular basis

2. Stormwater Management Facilities

All components of the stormwater management facilities shall be checked monthly between March and November and maintained as necessary to ensure proper performance. It is critical that all inflows and outflows to the detention facility are clean and performing as designed. In addition, the design volume of the detention facility shall also be maintained. Inspections for the following specific items should be conducted monthly between March and November:

Side Slopes/Embankment/Emergency Overflow Structure

____ Inspect embankments for settlement and erosion
____ Remove woody growth from the embankment
____ Any breaks, hire Registered Professional Engineer for design resolution
____ Seed and sod any eroded areas
____ Signs of piping (leakage), repair
____ Signs of seepage or wet spots on the downstream face of a berm, may require toe drains or chimney drains to solve problems
____ Stabilize emergency overflow structure if erosion observed
____ Remove obstructions blocking emergency overflow spillway

Vegetated Areas

____ Regular mowing to control vegetation, no cutting of native vegetation
____ Need for planting, reseeding or sodding. Supplement alternative native vegetation if a significant portion has not established (50% of the surface area). Reseed with alternative grass species if original grass cover has not successfully established.
____ Evidence of grazing, motorbikes or other vehicles, repair
____ Check for invasive vegetation, remove where possible
____ All vegetation must be maintained per the approved planting plan

Outlet Control Structure
____ Inspect restrictor and remove debris if clogged or discharge reduced
____ Remove accumulated sediment at outlet
____ Scour and erosion at outlet, repair and reseed
____ Any ice damage to outlet of pipe, repair if necessary
____ Condition of trash tracks, remove debris
____ Outlet channel conditions downstream

Access for Maintenance Equipment
____ Remove any obstructions placed in maintenance easements

Safety Features
____ Access controls to hazardous areas
____ Fences
____ Loose or damaged posts
____ Loose or broken wires
____ Accumulated debris in fences
____ Condition of gates
____ Signs

Detention Volume
____ Inspect all stormwater detention facilities to ensure that the constructed volume for detention is maintained. No sediment, topsoil, or other dumping into the facility shall be allowed. Specific locations in the stormwater management system, designed to accumulate sediment, shall be dredged as necessary to prevent sediment from reaching the invert of any gravity outlet pipe.

3. Volume Control Facility

Routine inspections and maintenance of volume control facilities shall be performed by the Owner on a yearly or as-needed basis. Specific items of concern include:

____ Facility shall be inspected yearly using the monitoring well to verify the system is functioning properly.
____ Surface of permeable pavement shall be cleaned with a low-pressure power washer.
____ Accumulated sediment from surface shall be vacuumed out and disposed of properly.
____ Appropriate signage shall be repaired if damaged or illegible.

4. Stormwater Collection System

The Owner shall perform monthly inspections of all components of the stormwater collection system. The monthly inspection shall occur between March and November and include the following specific areas of concern:

Storm Inlets/Manholes
____ Remove accumulated leaves and other debris from grates

____ Reset covers/lids on as-needed basis
____ Remove accumulated sediment from bottom of manhole when 50% of sump is filled

Storm Sewers/Culverts
____ Visually inspect pipes by removing manhole lids, make repairs as necessary
____ Storm sewers and culverts shall be checked for siltation deposits at inlets, outlets, and within the conduit, clean out as necessary
____ Restore riprap at outfalls if erosion observed
____ Restore riprap at outfalls
____ Replant and reseed any eroded areas

Overland Flow Routes (Ditches/Swales)
____ Annual visual inspections shall be performed that verify the design capacity of the overland flow routes is maintained. The slope and cross-sectional area of the ditch/swale shall be verified during this inspection.
____ Remove any obstructions that have been placed in the drainage path
____ Seed and sod any eroded areas
____ Restore riprap as necessary
____ Regrade to provide positive drainage as necessary (A Professional Land Surveyor may be required to check grades to ensure positive drainage).
____ Regular mowing to control vegetation
____ Rototill bottom of dry swales if not drawing down within 48-hours

5. Vegetated Areas
____ Need for planting, reseeding, or sodding. Supplement alternative native vegetation if a significant portion has not established (50% of the surface area after second growing season). Reseed with alternative native grass species if original grass cover has not successfully established.
____ Evidence of grazing, motorbikes, or other vehicles, repair.
____ Check for invasive vegetation, remove when possible.
____ Regular mowing to control vegetation; it is recommended that native vegetation remain uncut.
____ Dead or damaged non-native grassy areas – repair with seeding with fertilization or seeding with mulch.
____ Compensatory storage area shall be reseeded with appropriate vegetation according to the approved planting plan.

6. Qualified Sewer Construction
____ Perform manhole inspections once every five years, make repairs as necessary.
____ Perform sewer inspections once every five years, make repairs as necessary.
____ Perform regular sewer cleaning so that every sewer segment is cleaned once every five years.
____ Remove any obstructions placed in maintenance easements that may impede maintenance equipment access.

SAMPLE - WETLAND MITIGATION
5 YEAR MANAGEMENT AND MONITORING PLAN

DATE

PREPARED FOR:

(USACE Application No. LRC-XXXX)
(XYZ Project No. XX-XXXX)

Introduction

The (OWNER) will implement a 5-Year Wetland Management and Monitoring Plan for the wetland mitigation and natural areas within the ______ project area. The purpose of this Wetland Management and Monitoring Plan is to define the responsibilities of OWNER in regards to the wetland mitigation and restoration.

The success or failure of the project is largely dependent upon completion of maintenance and monitoring during the five-year management program. The following Wetland Management and Monitoring Plan includes a schedule describing Wetland Mitigation Performance Standards and Reporting and Compliance requirements.

Vegetation Performance Standards

The following Ecological Performance Standards apply to USACE wetland restoration and enhancement areas, and associated buffer that are providing wetland mitigation credit. The limits of these combined areas are shown on the attached map and identified as “USACE REGULATED WATERS, WETLAND, AND BUFFER LIMITS”.

1. A temporary cover crop shall be planted on all slopes immediately upon completion of any earthwork to prevent soil erosion. Soil erosion and sediment control measures shall be in place during all construction work. An erosion control blanket may also be required depending on site conditions and season of planting. Within three (3) months, at least 90% of this area, as measured by aerial coverage, will be vegetated. If the desired long-term slope vegetation is not planted with the temporary crop, it shall then be planted in the first available growing season appropriate for each plant community. All cover crop species shall be non-persistent or native and not allelopathic.

2. Species selected for the planting shall be native to the county where the mitigation site is located (ref. Swink and Wilhelm, Plants of the Chicago Region, 1994), and shall be appropriate for the hydrologic zone to be planted.
   - **Marsh**- minimum of 15 native perennial species
   - **Sedge meadow/wet prairie**- minimum of 35 native perennial species
   - **Mesic Prairie** (buffer) - minimum of 25 native perennial species

3. At least 50% of the required minimum number of species shall occur at a 10% frequency or greater, within each plant community zone or area. Multiple transects within a given plant community may be combined for this frequency analysis.

4. A native mean coefficient of conservatism value (native mean C value) of greater than or equal to 3.5 shall be achieved in each separate vegetated plant community (e.g. wet prairie, marsh, mesic prairie buffer), and as measured over the entire mitigation site area. Native plant species coefficients of conservatism are designated in Swink, Floyd and Gerould Wilhelm, Plants of the Chicago Region (Indianapolis: Indiana Academy of Science, 4th edition, 1994).

   Interim Yearly Standards:

   a. By the end of the first full growing season, at least 30% of the vegetation present within the planted wetland and buffer restoration area shall be native, non-invasive species. This standard does not apply to emergent communities or existing previously vegetated wetland or buffer.

   b. By the end of the second full growing season, at least 50% of the vegetation present within the planted wetland and buffer restoration area shall be native, non-invasive species. This standard does not apply to emergent communities or existing previously vegetated wetland or buffer.

   c. By the end of the third full growing season, at least 60% of the vegetation present within the planted wetland and buffer restoration area shall be native, non-invasive species. This standard does not apply to emergent communities or existing previously vegetated wetland or buffer.

   d. By the end of the fourth and fifth full growing seasons, at least 80% of the vegetation present within the planted wetland and buffer restoration area shall be native, non-invasive species. This standard does not apply to emergent communities or existing previously vegetated wetland or buffer.

5. The native floristic quality index value (native FQI) shall be greater than or equal to 20 in each separate vegetated community zone and as measured over the entire mitigation site. The floristic quality assessment method is described in Swink and Wilhelm, Plants of the Chicago Region.

   Steps # 4 and #5 are evaluated based upon the overall plant community inventories as well as transect summaries. If a portion of the site has achieved compliance with the performance standards, the standard shall be maintained in that portion until the final compliance sign off for the mitigation site.

6. No area over the entire mitigation site greater than 1 square meter shall be devoid of vegetation, as measured by aerial coverage, unless specified on approved mitigation plans. This standard does not apply to emergent, streamside and aquatic communities.

7. None of the three most dominant plant species in any of the wetland community zones may be non-native species or weedy species, including but not limited to:

   - Typha angustifolia
   - Typha X glauca
   - Phragmites australis
   - Lythrum salicaria
   - Salix interior
   - Phalaris arundinacea

   These species shall not cumulatively comprise more than 5% of the total percent cover (not relative cover) for each planted restored community. This standard does not apply to existing emergent wetland, streamside and aquatic communities or enhancement areas.

8. The native perennial species within each wetland plant community shall represent at least 80% of the total dominance measure. A lower percent native perennial species of the total dominance measure may be acceptable if it is demonstrated with transect data that the remaining dominance percentage is by native annual and biennial wetland plant species and the FQI and mean C standards are exceeded.

9. A vegetation map of the mitigation site based on as-built drawings developed at the completion of implementation shall be submitted. This information shall be descriptive and define the limits of all vegetation areas by community type, based on field observations. The permanent transects shall be shown on this map. Representative photographs of each vegetation area by general community zone shall be submitted to the Corps.

Hydrology Performance Standards

Consistent with the Corps of Engineers Wetlands Delineation Manual (1987) and/or any appropriate regional supplements, all areas to receive credit as wetland plant communities shall have soils saturated within 12 inches or less of the ground surface for at least 12.5% of the growing season as defined in this ICA. To meet this standard the mitigation site shall demonstrate inundated or saturated soils for 23 consecutive days during the growing season. In addition to this minimum, hydrology data should reflect a hydrologic regime that is appropriate to the native plant community proposed for establishment.

Monitoring Standards

Monitoring and data collection are intended to assess whether the mitigation has attained the following performance standards for full credit release and certification. Monitoring is required for five (5) years from the completion of planting of the wetland area. It shall also be recognized that monitoring may need to continue beyond the five (5) year period until full performance standards are attained. This may be especially true for forested communities with a longer growing time to maturity.

Wetland Delineation

To meet full performance standards, a routine wetland delineation shall be performed to verify the total acreage of wetlands and waters achieved on site. If requested by the Corps, the wetland areas shall be staked for final inspection. The Corps may request that the property boundaries for the mitigation site shall be marked as well. The delineation shall be included/reported in the final monitoring report, if not before. It is recognized that the actual acreage of aquatic resources/wetland will vary from that in the plans; however, it shall approach or exceed the acreage specified in the permit.

Vegetation Monitoring

Permanent straight line sampling transects shall be established, plotted onto project drawings and a current aerial photograph of the site, across each proposed plant community of the mitigation site. Sufficient transects shall be established to provide full representation of all plant communities within the site, which might include more than one of each type. Each transect shall consist of a series of 1.0 square meter quadrats (no fewer than 10) at regular or random intervals (5-10m suggested interval). The number of quadrats depends on system complexity and the size of each plant community for which credit is sought. A rough guideline is 2 quadrats per acre in each plant community as a minimum. The plant sampling shall be done in May/June and August/September each year following the initial planting, throughout the monitoring period. Data shall be reported by plant community, and by transect. A total plant species list should be compiled over the entire site for which credit is sought. Data may be summarized by plant community for which credit is sought in monitoring reports, however, the full sampling data should be provided in an appendix to the annual monitoring report. Species dominance shall be determined by calculating importance values, with at least the following two parameters: frequency and percent cover. Absolute percent aerial cover data should be reported, though the frequency and cover may be relativized to calculate Importance Values (e.g. RF + RC = IV).

Monitoring Reports

1. The Chicago District shall determine the information to be included in monitoring reports. This information shall be sufficient for the Chicago District to determine how the compensatory mitigation project is progressing towards meeting its performance standards,

and may include plans (such as as-built plans), maps, and photographs to illustrate site conditions. Monitoring reports may also include the results of functional, condition, or other assessments used to provide quantitative or qualitative measures of the functions provided by the compensatory mitigation project site.

2. The permittee or sponsor is responsible for submitting monitoring reports in accordance with the special conditions of the DA permit or the terms of the instrument. Failure to submit monitoring reports in a timely manner may result in compliance action by the Chicago District.

3. Monitoring reports shall be provided by the Chicago District to interested federal, tribal, state, and local resource agencies, and the public, upon request.

Adaptive Management

1. If the compensatory mitigation project cannot be constructed in accordance with the approved mitigation plans, the permittee or sponsor shall notify the Chicago District. A significant modification of the compensatory mitigation project requires approval from the Chicago District.

2. If monitoring or other information indicates that the compensatory mitigation project is not progressing towards meeting its performance standards as anticipated, the responsible party shall notify the Chicago District as soon as possible. The Chicago District will evaluate and pursue measures to address deficiencies in the compensatory mitigation project. The Chicago District will consider whether the compensatory mitigation project is providing ecological benefits comparable to the original objectives of the compensatory mitigation project.

3. The Chicago District, in consultation with the responsible party (and other federal, tribal, state, and local agencies, as appropriate), will determine the appropriate measures. The measures may include site modifications; design changes, revisions to maintenance requirements, and revised monitoring requirements. The measures shall be designed to ensure that the modified compensatory mitigation project provides aquatic resource functions comparable to those described in the mitigation plan objectives.

4. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies in the compensatory mitigation project. Performance standards may also be revised to reflect changes in management strategies and objectives if the new standards provide for ecological benefits that are comparable or superior to the approved compensatory mitigation project. No other revisions to performance standards will be allowed except in the case of natural disasters.

Long Term Management

1. The applicant shall submit a long term management strategy with an associated financial assurance plan for Chicago District approval prior to authorization. The strategy shall include a description of long-term management needs, annual cost estimates for those needs, and identify the funding mechanism that will be utilized to meet the needs. The applicant shall also identify the entity responsible (and provide supporting documentation, e.g. agreement or letter of intent) for the ownership and long-term management of the site. Identifying the responsible entity prior to permit issuance will aid in the processing of the instrument. It is preferred that the proposed long term manager or organization have expertise in executing adaptive management procedures. Applicants shall establish agreements for long-term management with public or private conservation organizations with final approval of the Chicago District.

2. All land, including associated uplands, which are part of the mitigation site shall be protected from future development by a permanent conservation easement, deed restriction or other real estate instruments as deemed appropriate by the Chicago District. This easement or deed restriction, along with a map of the site, shall be recorded with the appropriate county register of deeds, attached to the abstract of title, with a certified copy of the registration provided to the Chicago District prior to authorization.

Compliance Signoff

The Chicago District will issue final approval at the end of the management and monitoring period if the mitigation is in compliance and the Long Term Manager has been established for the site. The Long Term Manager shall provide supporting documentation stating their acceptance of the site in perpetuity. To be successful, the mitigation shall demonstrate the characteristics specified in the approved mitigation plan, the stated goals, and the Mitigation Requirements. Failure to comply with all the terms and conditions of a Department of the Army permit, including the mitigation plan and Mitigation Requirements, at any time may result in suspension and/or revocation of the permit and additional enforcement actions. The Corps may issue early compliance signoff if the required performance standards have been met. If the mitigation fails, the permittee will be required to determine the cause of the failure and to correct the error at the mitigation site, or to conduct additional mitigation activities.

The TOLLWAY shall also be responsible for successful completion and submittal of the required Special Condition project documentation to the Illinois Environmental Protection Agency, as listed in Item Number 8 of the IEPA October 16, 2013, Water Quality Certification.

REFERENCES

Hillsborough County Public Works Department. 2006. Stormwater Facility Maintenance Manual. Available at:
http://www.hillsborough.wateratlas.usf.edu/ccdpm/CanalStudy/Preventative%20Measures/Appendix%20A/SW%20Maintenance%20Manual.PDF

Illinois Environmental Protection Agency.2013.General NPDES Permit No. ILR10. Available at:
http://www.epa.state.il.us/water/permits/storm-water/general-construction-permit.pdf

Kane County Technical Reference Manual. Available at:
http://www.countyofkane.org/FDER/Documents/waterOrdinances/technicalManual.pdf

Metcalf and Eddy. 1989. Separate **Sanitary Sewer** Collection System Operation and **Maintenance** Manual for Local Agencies Tributary to the Metropolitan Sanitary **District** of Greater Chicago. Available at:
https://www.mwrd.org/irj/portal/anonymous/Infiltration

Montgomery County Department of Environmental Protection. 1999. *Maintaining Urban Stormwater Facilities: A Guidebook for Common Ownership Communities.* Available at:
http://www6.montgomerycountymd.gov/ocptmpl.asp?url=/content/ocp/ccoc/ccoc_index.as

New England Interstate Water Pollution Control Commission (NEIWPCC).2003. Operation, Maintenance and Rehabilitation Techniques, Chapter 7, Optimizing Operation, Maintenance, and Rehabilitation of Sanitary Sewer Collection Systems. Available at:
http://www.neiwpcc.org/neiwpcc_docs/WEBOM&R.CH7.pdf

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2005. *Example BMP Inspection and Maintenance Checklist. Available at:* www.scvurppp-w2k.com/bmp_om_forms.htm

US Environmental Protection Agency. 2000. “Collection Systems Technology Fact Sheet: Sewers, Lift Stations.” Available at:
http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_sewers-lift_station.pdf

US Environmental Protection Agency. 2005. Guide for Evaluating Capacity, Management, Operation, and Maintenance Programs for Sanitary Sewer Collection Systems. Available at:
http://www.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf

Water Environment Federation. 1998. *Urban Runoff Quality Management*. WEF Manual of Practice No. 23, ASCE Manual and Report on Engineering Practice No. 87.

ARTICLE 10: INSPECTIONS

The WMO requires inspections of all **developments** and **qualified sewer construction**. Inspections are generally defined as an examination of a product, process, service, or installation or their design and a determination of its conformity with specific requirements. The results of the inspections are compared to specified requirements and standards for determining whether the item is in line with the plans and specifications. Inspections are completed to ensure that projects meet requirements of the WMO, will be long-lived, and are safe for the general public.

General

The **District** is authorized to inspect any **development** under the **District's** regulation and any **development** or **qualified sewer construction** requiring a **watershed management permit** (§1000.1 and §1000.2). **Authorized municipalities** also are required to periodically inspect **developments** which require a **watershed management permit** (§1000.3). Periodic inspections during construction should be performed to insure that construction is being performed in compliance with the permitted plans. The inspections should be completed:

1) Following initial soil **erosion** and **sediment** control installation;
2) During excavation for sewers (storm and sanitary), **detention facilities**, and other **stormwater** infrastructure; and
3) At the completion of the **development** to verify that the work is in accordance with the plans and specifications. Completion of the **development** refers to when the **site** is permanently **stabilized** and all temporary **erosion and sediment control practices** have been removed.

In general, the **District** will be performing the sanitary sewer inspections and the **authorized municipality** will be responsible for the other inspections. **Authorized municipalities** will handle the inspections of **erosion and sediment control practices** and **stormwater** management systems, but **sanitary sewer** installation will remain the sole responsibility of the **District**. The **District** will typically only handle the inspections of **storm sewers** if the **development** is in a **combined sewer area**. However, since the **District** is authorized to inspect the **development** at any time, they may handle additional inspections in some cases.

Inspection Requirements to be met by the Development

Proposed **developments**' specific inspection requirements are listed within the WMO under §1001; however, noteworthy requirements of this section are discussed below.

- Two working days' notice shall be given prior to any milestone events to allow the inspectors an opportunity to visit the **site** during construction of the infrastructure of concern.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

- A complete set of the approved construction plans and specifications and the associated permit shall be kept on **site**, or be readily available for viewing at the time of inspection.
- Backfilling of trenches shall not be completed until the sewer installation has been inspected in accordance with the WMO.
- Construction records shall be maintained and readily available to the inspector when requested. These include the **Stormwater** Pollution Prevention Plan (SWPPP), the latest revision of plans and specifications, a construction schedule, project **site** photo documentation, and copies of all other federal, state, and local permits.
- If work proceeds without proper inspection, the work shall be exposed at the **owner's** expense to allow such inspections to be completed and to confirm that the work was completed in accordance with the approved plans and specifications.

Inspection Requirements for Erosion and Sediment Control Practices

In accordance with the WMO (§1000.4), inspections must be performed by a qualified **person** (as defined in Article 3 of the **TGM**) to verify the **development** is in compliance with the soil **erosion** and **sediment** control requirements of the WMO. An initial inspection of soil **erosion and sediment control practices** should occur after mobilization and installation of initial **erosion and sediment control practices**, prior to any soil disturbance (§1000.4A).

In accordance with **NPDES** General Permit ILR10, the **co-permittee** (developer) is responsible for inspections at least once every seven calendar days and within 24 hours of the end of a storm – or by the end of the following business or work day – that is 0.5 inches or greater rain event. Inspections may be reduced to once per month when construction activities have ceased due to frozen conditions. Inspections must commence when construction activities are conducted, or if there is a 0.5 inches or greater rain event, or discharge due to snowmelt occurs. In addition, the **permittee** (**municipality**) is responsible for performing periodic inspections of each **development**.

An assessment should be made and documented in a report on whether the soil **erosion and sediment control practices** are performing properly, as compared to the specifications contained in the plans and/or ***Illinois Urban Manual***. All remedial actions taken to repair or install soil **erosion** and **sediment** controls should be completed within 7 days of their discovery, unless the repair or installation is resulting in a pollutant discharge, in which the remedial action must occur immediately.

As shown in Figure 10.1, an inspection report has been developed for the inspection of **erosion and sediment control practices**. A fillable version of the inspection form is available on the **District's** website at:

http://www.mwrd.org/irj/portal/anonymous/managementordinance

Post-Construction Inspection Requirements

Inspections should be performed after the project is constructed to verify that the **development** has been constructed as permitted and is in compliance with the issued **watershed management permit**. **Record drawings** must be submitted and compared to the originally permitted plans. The post-construction inspection should identify any areas of failed construction and verify that all components of the **stormwater management system** are functioning as they were designed. A copy of the post-construction inspection report is provided as Figure 10.2. A fillable version of the inspection form is available on the **District's** website at:

http://www.mwrd.org/irj/portal/anonymous/managementordinance

It should be noted that this form will be required in addition to *the Request for Final Inspection* (RFI) form, which is still required by the **District** for all **developments**. For developments within **authorized municipalities**, the applicant will submit the RFI to the **authorized municipality** for approval. However, if **District** approval is also required, the final inspection cannot be approved by the **authorized municipality** without a completed and approved inspection report by the **District**.

Erosion and Sediment Control Inspection Report

General Information			
Project Name		Approximate Acreage:	
Owner/Permittee			
Watershed Management Permit No.:			
Site Location			
Date of Site Visit		NPDES Permit No. (if applicable): ILR	
Observer's Name & Title			
Enforcement Officer			
Stage of Construction		Photos Taken ☐ Yes ☐ No	
Type of Site Visit: ☐ Routine ☐ Post-Storm Event ☐ Other:			
Weather Information			
Weather Conditions:			
Estimated end date of most recent ≥ 0.5" rain event:			
Site Observations – Describe Location and Recommend Corrective Measures on Back Page			

No.	BMP/Activity	Implemented & Maintained
1	Are discharge points and receiving waters free of sediment deposits and other pollutants?	☐ Yes ☐ Action Item ☐ N/A
2	Have BMPs specified in the SWPPP been installed and maintained?	☐ Yes ☐ Action Item ☐ N/A
3	Has the SWPPP been updated to reflect the current conditions on site?	☐ Yes ☐ Action Item ☐ N/A
4	Are outlets protected/stabilized?	☐ Yes ☐ Action Item ☐ N/A
5	Have stormwater management systems been constructed, stabilized, and verified to be functioning appropriately?	☐ Yes ☐ Action Item ☐ N/A
6	Are Special Management Areas (e.g., creeks, wetlands, buffers, etc.) adequately protected?	☐ Yes ☐ Action Item ☐ N/A
7	Are storm drain inlets adequately protected?	☐ Yes ☐ Action Item ☐ N/A
8	Have all idle, disturbed areas been temporarily stabilized?	☐ Yes ☐ Action Item ☐ N/A
9	Are erodible stockpiles (e.g., topsoil) properly located and adequately protected?	☐ Yes ☐ Action Item ☐ N/A
10	Are washout facilities (e.g., concrete washouts, etc.) available and maintained?	☐ Yes ☐ Action Item ☐ N/A
11	Is waste, including building materials and construction debris, collected and placed in approved receptacles?	☐ Yes ☐ Action Item ☐ N/A
12	Are non-stormwater discharges (e.g., dewatering) properly controlled?	☐ Yes ☐ Action Item ☐ N/A
13	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other potential pollutants?	☐ Yes ☐ Action Item ☐ N/A
14	Are portable toilets, material storage areas, and materials that are potential stormwater contaminants managed appropriately?	☐ Yes ☐ Action Item ☐ N/A
15	Are stabilized entrances installed and are adjacent roads clear of sediment?	☐ Yes ☐ Action Item ☐ N/A
16	Other, based on site conditions:	☐ Yes ☐ Action Item ☐ N/A

Erosion and Sediment Control Inspection Report 1

Figure 10.1a. Erosion and Sediment Control Inspection Report (Page 1 of 2)

No.	Location and Recommended Corrective Measure	Completed/Initial
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐

General Comments:

Certification Statement: *(To address NPDES Permit No. ILR10 requirements)*

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print Name & Title: ______________________________

Signature: ______________________ Date: ______________________

Erosion and Sediment Control Inspection Report 2

Figure 10.1b. Erosion and Sediment Control Inspection Report (Page 2 of 2)

Post-Construction Inspection Report

General Information			
Project Name		**Approximate Acreage:**	
Owner/Permittee			
Watershed Management Permit No.:			
Site Location			
Date of Site Visit		**Photos Taken** ☐ Yes ☐ No	
Observer's Name & Title			
Enforcement Officer			

No.	Development Component	Addressed?
1	Have record drawings been submitted for the development?	☐ Yes ☐ No ☐ N/A
2	Are all stormwater detention facilities functional and are they consistent with the record drawings from the permitted plans?	
3	Are the outlet control structures for the detention facilities appropriately sized?	
4	Are the outlet control structures for the detention facilities functional and free of debris?	
5	Is there any evidence of failed construction, such as the settlement of berms, slope instability/erosion, accumulated sediment in the detention facility, etc.?	
6	Are all overland flow routes free of obstruction and are they consistent with the record drawings from the permitted plans?	
7	Are all volume control practices functional and are they consistent with the record drawings from the permitted plans?	
8	Are all other stormwater management system components functional and are they consistent with the record drawings from the permitted plans?	
9	Are onsite wetland buffers in place and free of any prohibited activities?	
10	Have all erosion and sediment control practices that are no longer needed been removed?	
11	Other, based on site conditions:	

No.	Location and Recommended Corrective Measure	Completed/Initial
1		☐
2		☐
3		☐
4		☐
5		☐
6		☐
7		☐
8		☐
9		☐
10		☐
11		☐

2/14 Post-Construction Inspection Report 1

Figure 10.2. Post-Construction Inspection Report

Special Requirements for Qualified Sewer Construction

Projects with **qualified sewer construction** permitted by the **District** have additional inspection requirements. The specific inspection requirements of this section are listed within the WMO under §1002; however, noteworthy requirements of this section are discussed below.

- All sewers approved shall be tested, at no cost to the **District**, and approved by the **District**; and
- No backfilling of trenches may occur without authorization of the **District**. The approval shall be maintained on **site** and be available for future review by the **District**.

Request for Final Inspection

For projects permitted by the **District**, requests for Final Inspection will follow the protocol specified in §1003 of the WMO; however, noteworthy requirements of this section are discussed below.

- A request for Final Inspection must include a properly executed *Request for Final Inspection* approval form, and the **District** must be given at least 2 working days' notice to allow scheduling of the **site** visit. The form can be found on the **District's** website at:

  http://www.mwrd.org/irj/portal/anonymous/EngForms

  The form must be submitted to:

  MWRD Engineering Department
  Local Sewer Systems Section
  6001 Pershing Road
  Cicero, IL 60804

- The sewer cannot be placed into service until all onsite facilities, which are required as conditions of the **Watershed Management Permit**, excluding landscaping, have been approved.
- **Record drawings** will have to be prepared and provided to the **District** prior to final inspection.
- Prior to final inspection a copy of the recorded documents shall be provided to the **District**. If the documents have not been recorded the **District** may complete the recording at the cost of the **permittee**.

ARTICLE 14: ADMINISTRATION

The purpose of this article is to provide guidance on the responsibilities of both the **District** and an **authorized municipality** for the enforcement of the regulations contained in the WMO. This article outlines the procedures and requirements for **municipalities** to be granted the authority to administer certain aspects of the WMO within their corporate boundaries. This article also provides clarification on the role of the **District** and the **authorized municipality** for issuing **Watershed Management Permits** for various types of **developments**, performing inspections, maintaining records, and resolving violations of the WMO.

§1400 Responsibility for Administration

The **District** has the authority and responsibility for administering the regulations contained in the WMO. Although **authorized municipalities** have the ability to issue certain **Watershed Management Permits** within their corporate boundaries, the **District** will oversee all **municipalities** within its jurisdiction to ensure compliance with the WMO.

§1401 Role of the District

As contained in §1401 of the WMO, the role of the **District** in the administration of the WMO includes the following:

A. Supervising the execution of the WMO;

B. Reviewing and issuing **Watershed Management Permits**;

C. Developing and maintaining the **TGM**, which will serve as a companion reference to the WMO;

D. Notifying **Cook County** governmental agencies, **municipalities**, **authorized municipalities**, **FEMA**, **OWR**, **Corps**, and **IEPA** of any amendments to the WMO;

E. Providing inspections to ensure proper compliance with the WMO;

F. Investigating complaints of violations of the WMO;

G. Granting **variances**;

H. Enforcing the WMO;

I. Hearing appeals;

J. Advising, consulting with, and cooperating with other governmental entities to promote the purposes of the WMO; and

K. Supervising **authorized municipalities**.

Note: All bold terms contained in this document are defined terms in the WMO. Refer to Appendix A of the WMO or the TGM for the definition of each bold term.

Additionally, the **District** will timely review **Watershed Management Permit** applications and respond within:

A. Fifteen (15) working days of an initial submittal for **developments** not involving **flood protection areas**;

B. Thirty (30) working days of an initial submittal for **developments** involving **flood protection areas**; and

C. Ten (10) working days of a resubmittal.

§1402 Role of an Authorized Municipality

Article 14 of the WMO allows local **municipalities** to become authorized to administer certain aspects of the WMO. Such **municipalities** are referred to as **authorized municipalities**. Referring to §201.2 of the WMO, there are certain **development** activities for which an **authorized municipality** does not have authority to issue a **Watershed Management Permit**. The **Watershed Management Permit** must have **District** approval prior to issuance for the following **developments**:

- **Development** that involves modification to the drainage system of a previously permitted **detention facility**;
- **Development** proposing reconfiguration of existing **major** or **minor stormwater systems** which alters the service area of a permitted or **existing detention facility**;
- Any **development** that is considered **qualified sewer construction**;
- **Development** that involves a sewer or connection to **District** sewers, reservoirs, facilities, interceptors, or **TARP structures**;
- **Development** that involves the modification of a new drainage system or **outfall** to a **waterway** or Lake Michigan;
- **Development** discharging **stormwater** directly to **District** property; and
- **Non-residential development** on septic systems or private treatment systems proposing a connection to a **sanitary sewer** (tributary to a **District** facility).

Additionally, **authorized municipalities** may not issue permits for projects located in a **combined sewer area** or for their own projects.

An **authorized municipality** has the authority to issue a **Watershed Management Permit** for the following types of **development** activities:

- **Development** where the land disturbance is greater than 0.5 acres;

- **Development** within a **flood protection area**;
- **Development** involving an **indirect wetland impact**; and
- **Development** that constitutes a **substantial improvement** to a **structure** in the **floodplain.**

When a new application is submitted, the **authorized municipality** should complete a *WMO Authorized Municipality Permit Form* and send it to the **District** to obtain an MWRD **Watershed Management Permit** number for the project. The MWRD **Watershed Management Permit** number should be included on all documentation associated with each **Watershed Management Permit** application.

In addition to issuing **Watershed Management Permits** to certain types of **development**, the **authorized municipality** will also be responsible for:

- Providing all inspections that are necessary to ensure compliance with the WMO;
- Investigating complaints of violations; and
- Advising, consulting with, and cooperating with other governmental entities to promote the purposes of the WMO.

Qualifications for Authorized Municipality

For a community to qualify as an **authorized municipality**, it must meet the following requirements:

A. Have legal authority to perform all requirements of an **authorized municipality** as specified in the WMO*;*

B. Adopt the WMO, including all amendments, by reference;

C. Participate in the **NFIP**;

D. Have the ability to review and issue **Watershed Management Permits** for **development** activities in **separate sewer areas** listed in §201.1 of the WMO and within its corporate boundaries in conformance with the WMO;

E. Employ or retain by contract, adequate staff for all of the following positions:

   1) An **Enforcement Officer**;
   2) **Professional Engineer**(s); and
   3) **Wetland Specialist**(s);

F. Conduct timely reviews of **Watershed Management Permit** applications and respond within:

  1) Fifteen (15) working days of an initial submittal for **developments** not involving **flood protection areas**;
  2) Thirty (30) working days of an initial submittal for **developments** involving **flood protection areas**; and
  3) Ten (10) working days of a resubmittal;

G. Maintain all of the following records;

  1) **Watershed Management Permits**;
  2) **Record drawings**;
  3) **Structure** improvement data;
  4) **Elevation certificates**;
  5) **Wetland mitigation** bank credits;
  6) **Base flood** data and **base flood** maps; and
  7) **LOMC**, **LOMR**;

H. Transmit all records specified in §1402.2.G of the WMO to the **District** within ten (10) calendar days of request;

I. Issue **Watershed Management Permits** for **development** activities listed in §201.1 of the WMO within its corporate boundaries in conformance with the WMO;

J. Inspect the construction of all **developments** which require a **Watershed Management Permit** from the **authorized municipality**;

K. Notify the **District** promptly for any violation within the **authorized municipality**;

L. Issue local stop work orders for all violations, when appropriate; and

M. Establish **Watershed Management Permit** fees for **Watershed Management Permits** reviewed and issued by the **authorized municipality**.

In addition to the record keeping requirements noted above, the **Enforcement Officer** of an **authorized municipality** must complete the Annual Permit Summary Report each calendar year. The purpose of this report is to provide an inventory of all **developments** permitted within the **authorized municipality**, the status of the projects (pre-construction, during construction, and post-construction), as well as the permitting components of the project.

The annual report must be completed each calendar year by the following March 31, and should describe all **development** activities that have taken place during the previous year. The form is available on-line through the **District's** website at: wmo.mwrd.org.

§1403 Procedure for Authorization

A **municipality** may become authorized at any point in time. To become authorized, the **municipality** must complete the following three steps:

1) Submit a letter of intent (with supporting documentation) to the **District** to become an **authorized municipality**. Also provide contact information for the **Enforcement Officer**, **Professional Engineer**, and **Wetland Specialist** for the **municipality**;

2) Adopt the WMO by reference; and

3) Enter into intergovernmental agreement with the **District**.

Letter of Intent

Municipalities interested in authorization must first submit a letter of intent to the **District**. A sample letter of intent is provided as Figure 14.1 and is also available on-line through the **District**'s website at: wmo.mwrd.org. The letter of intent must be submitted to the **District's Director of Engineering** at the following address:

Director of Engineering
Metropolitan Water Reclamation District of Greater Chicago
100 E. Erie Street
Chicago, IL 60611

As shown in Figure 14.1, supporting documentation is required in addition to the letter of intent. This supporting documentation includes:

A. A statement of intent to adopt the WMO by reference;

B. A legal opinion indicating the **authorized municipality** has legal authority to perform all obligations required by the WMO including:

    1) The regulation of **erosion** and **sediment** control, **stormwater** management, **floodplains**, **isolated wetlands**, and **riparian environments**;
    2) The ability to conduct inspections;
    3) The issuance of **Watershed Management Permits**;
    4) The enforcement of the WMO; and
    5) The ability to enter into an intergovernmental agreement with the **District**.

    For a legal opinion, the **municipality** should contact the municipal attorney.

C. A verified statement of financial capability to perform and adequately fund the obligations of the **authorized municipality**. This should be a letter from the community's chief financial officer (CFO) or budget officer that includes relevant excerpts from the municipal budget to show that it has the financial resources to hire/retain an **Enforcement Officer**, **Professional Engineer**, and **Wetland Specialist**;

D. Designation of an **Enforcement Officer**;

E. An implementation plan, which should include the estimated permit load, proposed staffing, the addressee of permit submittals, and estimated review turnaround time; and

F. Proposed staffing (**Enforcement Officer**, **Professional Engineer**, and **Wetland Specialist**).

<u>Intergovernmental Agreement</u>

An executed intergovernmental agreement between the **municipality** and the **District** will effectuate the **municipality**'s status as an **authorized municipality**. The **District** will create the initial intergovernmental agreement and forward it to the **municipality** for review and execution. A sample intergovernmental agreement is available on-line through the **District**'s website at: wmo.mwrd.org.

The intergovernmental agreement between the **District** and the **authorized municipality** shall remain effective unless terminated. The **authorized municipality** may terminate the intergovernmental agreement at any time, as long as a 60 day written notice is provided by the **municipality**.

<u>Contact Information</u>

As described in the letter of intent, the **municipality** must provide information on the proposed staff that will be responsible for enforcing the WMO. The **municipality** must provide contact information for the **Enforcement Officer**, **Professional Engineer**, and **Wetland Specialist** that will handle the review responsibilities on behalf of the community. A template for the contact information sheet is shown as Figure 14.2 and is available on the **District**'s website at: wmo.mwrd.org.

Month XX, Year

Mr./Ms. ____________________
Director of Engineering
Metropolitan Water Reclamation District of Greater Chicago
100 E. Erie Street
Chicago, Illinois 60611

Dear Mr./Ms. _________________:

Subject: Intent to become an authorized municipality to administer the Watershed Management Ordinance

The Town/City/Village of ____________________ ("municipality") intends to become authorized to adopt and administer the Watershed Management Ordinance ("WMO") to the extent allowed by Article 14 of that ordinance.

The municipality designates Mr./Ms. __________________ as the municipality's enforcement officer. All correspondence should be directed to Mr./Ms. ________________'s attention at the following address:

Street Address
City, State ZIP

Please find the following documents enclosed in support of this letter of intent.

1. Legal Opinion indicating the municipality has legal authority to perform all obligations required by the WMO, including:
    a. Regulating erosion and sediment control, stormwater management, floodplains, isolated wetlands, and riparian environments;
    b. Conducting inspections on private property;
    c. Issuing watershed management permits;
    d. Administering the WMO; and
    e. Entering into an intergovernmental agreement with the District.

2. A verified statement of financial capacity to perform and adequately fund the municipality's obligations related to the administration of the WMO as set forth in Article 14 of that ordinance.

3. An implementation plan, with an estimate of permit load and available review staff.

4. Schedule of Permit Fees.

5. An exhibit delineating the corporate limits of the municipality for the purposes of administering the WMO. Note that areas within the limits of the Combined Sewer Area Limits cannot be locally administered.

6. Contact information sheet.

Please contact the municipality's enforcement officer at (XXX) XXX-XXXX if you require further information.

Very truly yours,

Municipal Executive

Figure 14.1. Template Letter of Intent to Become an Authorized Municipality

Contact Information Sheet

The Town/City/Village of ________________ intends to become authorized to administer the Cook County Watershed Management Ordinance. Below is contact information for the Town's/City's/Villages's Enforcement Officer, Professional Engineer, and Wetland Specialist.

Enforcement Officer

NAME:______________________________
TITLE:______________________________
ORGANIZATION:______________________
STREET ADDRESS:____________________
CITY, STATE, ZIP:___________________
PHONE:_____________________________
FAX:________________________________
EMAIL:______________________________

Professional Engineer

NAME:______________________________, P.E.
TITLE:______________________________
ORGANIZATION:______________________
STREET ADDRESS:____________________
CITY, STATE, ZIP:___________________
PHONE:_____________________________
FAX:________________________________
EMAIL:______________________________

Wetland Specialist

NAME:______________________________
TITLE:______________________________
ORGANIZATION:______________________
STREET ADDRESS:____________________
CITY, STATE, ZIP:___________________
PHONE:_____________________________
FAX:________________________________
EMAIL:______________________________

Figure 14.2. Contact Information Form

Enforcement Officer

In **authorized municipalities**, the **Enforcement Officer** is responsible for the administration and enforcement of the WMO. The primary responsibility of the **Enforcement Officer** is to review **Watershed Management Permit** applications and issue **Watershed Management Permits** for proposed **developments**. Specific duties of the **Enforcement Officer** include the following:

- For each **Watershed Management Permit** application, determine whether the proposed **development** is located within the **regulatory floodplain** or **floodway**;
- Determine and solicit **District** review, as applicable;
- Review all plans, calculations, and analyses submitted as part of a **Watershed Management Permit** application;

- Verify that all required local, State, and federal permits have been obtained prior to issuance of a **Watershed Management Permit**;

- Issue the **Watershed Management Permit** (applicable **District** approval must be received prior to issuance);

- Review all proposed **Letters of Map Change** (**LOMC**) requests on behalf of the **municipality** and submit reports as required by the **National Flood Insurance Program** (**NFIP**);

- Periodically inspect the **development** before, during, and post-construction to ensure it is in compliance with the regulations of the WMO;

- Verify that the **development** has been constructed and maintained according to the permitted plans;

- Issue stop-work orders for non-compliant **developments** and investigate/remedy complaints of violations; and

- Maintain records of all **Watershed Management Permit** applications, issued permits, hydrologic and hydraulic analyses, inspection records, violations and other enforcement actions, **LOMC** information, **record drawings**, etc.

<u>Professional Engineer</u>
A **Professional Engineer** is an individual licensed by the State of Illinois to practice engineering and is responsible for the review of any plans, calculations, or analyses submitted by a **Professional Engineer** pursuant to the requirements of the WMO. As contained in the intergovernmental agreement between the **District** and an **authorized municipality**, the **Professional Engineer** should avoid possible conflicts of interest to perform work or provide services related to, or arising out of, the **municipality's** administration of the WMO.

<u>Wetland Specialist</u>
A **wetland specialist** is a **person** who is skilled in the art and science of delineating, identifying, and accessing **wetlands**. The **wetland specialist** is responsible for the review of all delineation reports, impacts, mitigation plans, and other documentation related to **wetlands**, buffers, and **riparian environments**. To qualify as a **wetland specialist**, a **person** must meet the requirements of A, B, C, or D below:

A. Certified as an Environmental Scientist in DuPage County or a Certified **Wetland Specialist** (CWS) in Lake County;
B. Professional **Wetland** Scientist certification by the Society of **Wetland** Scientists (SWS);
C. Minimum of a bachelor's degree in a biologic science or earth science <u>and</u> at least one of the following:
    1) Three (3) years cumulative (full-time) **wetlands** experience in the Upper Midwest

Region on **wetland**-related projects; or

2) Completion of at least 100 **wetland** delineation projects in the Upper Midwest Region;

D. Six (6) years cumulative (full-time) **wetlands** experience in the Upper Midwest Region on **wetland**-related projects without a degree type noted above.

§1404 District Oversight of Authorized Municipalities

Although **authorized municipalities** are delegated the authority to issue certain types of **Watershed Management Permits** within their corporate boundaries, the **District** retains the authority to oversee the enforcement of the WMO in all communities within its jurisdiction. The **District** has the authority to inspect any **development** within an **authorized municipality** and may, at any time, audit an **authorized municipality**. As specified in §1404.2 of the WMO, during an audit, the **District** may:

A. Inspect and copy pertinent records kept by an **authorized municipality**;

B. Inspect **Watershed Management Permits** issued by an **authorized municipality**;

C. Meet with staff of an **authorized municipality**;

D. Conduct field inspections of **developments** permitted by an **authorized municipality**;

E. Request and copy financial records of the **authorized municipality**;

F. Verify that an **authorized municipality** complies with all requirements listed in §1402.2 of the WMO; and

G. Verify that an **authorized municipality** does not violate any provision listed in §1402.3 of the WMO.

Following a **development** inspection or audit in an **authorized municipality**, the **Director of Engineering** shall promptly notify an **authorized municipality** of any of the following deficiencies:

A. Failure to comply with any provision of §1402.2 of the WMO;

B. Violation of any provision of §1402.3 of the WMO; or

C. Breach of the intergovernmental agreement.

An **authorized municipality** shall remedy any deficiency listed in §1404.4 of the WMO within thirty (30) calendar days of notice of the deficiency. In cases where a deficiency cannot be remedied within thirty days, the **Director of Engineering** may grant an extension.

The **Director of Engineering** may either suspend or terminate a **municipality**'s status as an **authorized municipality** if the **municipality** fails to remedy a violation in accordance with

§1404.4 of the WMO. If a **municipality**'s status as an **authorized municipality** is either suspended or terminated, the **municipality** may petition the **Director of Engineering** for reauthorization after all deficiencies are remedied.

Resources for Authorized Municipalities

The **District** has developed A Guide for Authorized Municipalities and numerous other resources that provide additional guidance for administering WMO permits. These resources include:

- *Erosion Control Inspection Form;*
- *Wetland Inspection Form;*
- *Post-Construction Inspection Form;*
- *WMO Authorized Municipality Permit Form;*
- WMO Minimum Permit Submittal Checklist;
- Sample Information Sheet;
- Request for Inspection (RFI) form; and
- Annual Permit Summary Report.

These resources are available under the *Resources for Authorized Municipalities* link on the **District**'s website at: wmo.mwrd.org.

Appendix A. Definitions

Interpretation of Terms and Words

The terms and words used in this **Ordinance** shall be interpreted as follows:

- Verbs and phrases in the present tense shall be presumed to include the future tense;
- Parts of speech used in the singular shall be presumed to include the plural, and those used in plural shall be presumed to include the singular;
- The words "shall," "will," and "must" are understood as mandatory, not permissive; and
- All distances shall be measured horizontally unless otherwise stated.
- A masculine, feminine or neuter pronoun shall not exclude the other genders.

Definitions

Words and terms not defined herein shall be understood by their common dictionary definition.

Within the context of this Ordinance, the following words and terms shall be defined as follows (except where otherwise specifically indicated):

100-Year Flood Elevation

The 100-year flood elevation is highest elevation of the BFE or a project-specific 100-year flood elevation.

Accessory Structure

A detached, non-habitable **building** without sanitary facilities that is an accessory to an existing **building** and that is less than 750 square feet in area. Accessory **structures** include, but are not limited, to garages and sheds.

Allowable Release Rate

The maximum or actual post-development release rate from a required **detention facility** as specified in §504.3 of this **Ordinance**, which is adjusted by existing **depressional storage** and/or **unrestricted flow** areas on the **site**.

Appellant

A **co-permittee** who appeals the **District**'s denial and/or imposition of conditions of a **Watershed Management Permit** or of a **variance** request.

Appropriate Use

The only types of development within the **regulatory floodway** that are eligible for a **Watershed Management Permit** as specified in §602.27 of this **Ordinance**.

Authorized Municipality

A **Cook County municipality** authorized by the **District** to issue **Watershed Management Permits** within its corporate boundaries.

Base Flood

The **flood** having a one percent probability of being equaled or exceeded in a given year. The **base flood** is also known as the "100-year flood."

Basement

Any area of a **building** having its floor below grade.

BB

Basement **B**ackup. Discharge of sanitary wastewater into the lower level of a building caused by either a blockage or collapse on the service lateral from the building to the public sewer system or by surcharging of the public sector sewer system.

BFE

Base **F**lood **E**levation. The height of the **base flood** in relation to the North American Vertical Datum of 1988 that is associated with the **Special Flood Hazard Area** on the effective **FIRM**. The **BFE** shall be determined by the effective Flood Insurance Study (**FIS**) for a **development site** at the time of application as determined by the criteria provided in §601.3 and §601.4 of this **Ordinance**.

Board of Commissioners

The nine-member Metropolitan Water Reclamation District of Greater Chicago's **Board of Commissioners** who are elected by the public.

BSC

Biological **S**tream **C**haracterization. A program developed by the Illinois Environmental Protection Agency (**IEPA**) in conjunction with biologists from the Illinois Department of Natural Resources (IDNR) to aid in the classification of streams throughout the **watersheds** of Illinois. The **BSC** utilizes the Alternative Index of Biotic Integrity (AIBI) to classify streams as A, B, C, D, or E. The ratings use fish, macroinvertebrates, crayfish, mussels, and threatened and endangered species information to generate an overall score of biological diversity and integrity in streams.

BSS

Biologically **S**ignificant **S**tream. Streams with a Biological Diversity or Integrity of "A", "B", or "C" according to the latest edition of the Illinois Department of Natural Resources (**NRCS**) Office of Resource Conservation: Biological Stream Ratings for Diversity, Integrity, and Significance.

Building

A structure that is constructed and is enclosed by walls and a roof, including manufactured homes. This term does not include accessory structures.

Building Envelope

The delineation between the interior and the exterior environments of a building and often depicted as the building foundation.

Bulletin 70

Huff, F.A., and J.R. Angel, 1989. "Rainfall Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois" (**Bulletin 70**), Illinois State Water Survey.

CCSMP

The **C**ook **C**ounty **S**tormwater **M**anagement **P**lan adopted by the Metropolitan Water Reclamation District of Greater Chicago **Board of Commissioners** on February 15, 2007, as amended from time to time.

CLOMA

Conditional **L**etter **o**f **M**ap **A**mendment. A **FEMA** comment letter on a **development** proposed to be located in, and affecting only that portion of, the area of **floodplain** outside the **regulatory floodway** and having no impact on the existing **regulatory floodway** or **BFEs**.

CLOMR

Conditional **L**etter **o**f **M**ap **R**evision. A letter that indicates that **FEMA** will revise **BFEs**, **flood** insurance rate zones, **flood** boundaries, or **floodways** as shown on an effective **FIRM** after the **record drawings** are submitted and approved.

Co-Permittee

A **person** applying for a **Watershed Management Permit**, who must be the **owner** of the land specified in the application, the **owner**'s representative, or a developer with the owner's authorization. In the event, the **co-permittee** is a beneficiary of a land trust that owns the land specified in the application, the **co-permittee** must have power of direction. [*Compare* **co-permittee** *with* **permittee** and **sole permittee**].

Combined Sewer

Sewers intended for the combined conveyance of **stormwater runoff** and wastewater flows. [*Compare* **combined sewer** *with* **sanitary sewer** and **storm sewer**].

Combined Sewer Area

Areas within the **District**'s corporate boundaries that have sewers intended for the combined conveyance of **stormwater runoff** and wastewater flows to a **District** wastewater storage or treatment facility. This regulatory limit should be considered the high water mark **of combined sewer area** service limits, and was established in the past to limit further expansion of areas served by **combined sewers**. This area does not represent the actual effective boundaries between combined and separate sewer sheds. Consult local sewer system atlas information for that level of detail. [*Compare* **combined sewer area** *with* **separate sewer *area***].

Compensatory Storage

An excavated volume of storage used to offset the loss of existing flood storage capacity when fill or **structures** are placed within the **floodplain**.

Compliance Report and Schedule

A report that specifies a schedule and final compliance date for which all violations and conditions contained in a **NON – Stormwater** and/or a **NONC** are remedied.

Connection Impact Fee

Fee for annexing to the **District**.

Contiguous

Adjacent to and touching at one point or more; if the lands are separated by an easement or a dedicated right-of-way, it shall be considered contiguous.

Cook County

Cook County is defined as the land area within the boundaries of Cook County, Illinois.

Corps

United States Army Corps of Engineers.

Corps Jurisdictional Determination

Procedure by which the Corps determines whether it has jurisdiction over a subject water as a waters of the United States. The purpose of a jurisdictional determination is to determine whether a wetland is a Corps jurisdictional wetland. For the purposes of this Ordinance, a wetland not under the jurisdiction of the Corps shall be considered an isolated wetland.

Corps Jurisdictional Wetlands

All **wetlands** that are under the jurisdiction of the **Corps**.

Corps Wetland Delineation Manual

The current Corps Wetland Delineation Manual, including any relevant regional supplements, or superseded and as authorized under Section 404 of the Clean Water Act.

Critical Duration Analysis

Study that determines which **storm event** duration results in the greatest peak **runoff** rate.

Dam

Any obstruction, wall embankment, or barrier, including the related abutments and appurtenant works, that is constructed to store, direct, or impound water. An underground water storage tank is not classified as a **dam**.

Demolition

Removal of **structures**, **impervious area**, or utilities that return a **parcel** to a natural or vacant state. **Demolition** must not affect the volume, flow rate, drainage pattern, or composition of **stormwater**. **Demolition** activities that change the use of the **site** or require any fill within a **flood protection area** are considered **development**. [*Compare* **demolition** *with* **maintenance***,* **maintenance activities***, and* **development***.*]

Depressional Storage

The volume potentially contained below a closed contour on a one-foot contour topographic map, with the upper elevation determined by the invert of a surface-gravity outlet.

Design Runoff Rate

The **runoff** rate, or flow rates, used to design **major stormwater systems** and determine offsite flow rates. **Design runoff rates** are calculated by using event hydrograph methods.

Detention Facility

A manmade **structure** providing temporary storage of **stormwater runoff** from a **development** with a release rate specified by this **Ordinance**. The **Detention Facility** includes a stormwater storage basin, control structure (or restrictor), and the basin outlet, overflow and inflow pipes.

Development

Any human-induced activity or change to real estate (including, but not limited to, grading, paving, excavation, dredging, fill, or mining; alteration, subdivision, change in land use or practice; **building**; or storage of equipment or materials) undertaken by private or public entities that affects the volume, flow rate, drainage pattern or composition of **stormwater**, or the **substantial improvement** of an existing **building** in a **Special Flood Hazard Area**. The term **development** shall include **redevelopment** and shall be understood to not include **maintenance, maintenance activities**, or **demolition**. [*Compare* **development** *with* **maintenance***,* **maintenance activities***, and* **demolition***.*]

Director of Engineering

The Director of Engineering of the Metropolitan Water Reclamation District of Greater Chicago, and his or her designee.

District

Metropolitan Water Reclamation **District** of Greater Chicago. A special-purpose district established by the State of Illinois to, among other things, manage wastewater for an area largely corresponding to **Cook County**, and **stormwater** in **Cook County**. The **District** is an independent unit of local government with an elected nine member **Board of Commissioners**.

Disturbed Area

Actual land surface area disrupted by construction activity.

Drainage Area

The land area tributary to a given point that contributes **runoff** from rainfall and/or snowmelt.

DWP

Detailed **W**atershed **P**lans. A study and evaluation by the **District** to assess the specific conditions and needs for each of the following **watersheds**: Calumet-Sag Channel, the Little Calumet River, the Lower Des Plaines River, the North Branch Chicago River, Poplar Creek, and the Upper Salt Creek.

Elevation Certificates

A form published by **FEMA** that is used to certify the **BFE** and the lowest elevation of a **building**'s **lowest floor**.

Enforcement Officer

A municipal official having actual authority from an **authorized municipality** to administer this **Ordinance** and issue **Watershed Management Permits**.

Erosion

The process of soil particle detachment from the land surface by the forces of wind, water, or gravity.

Erosion and Sediment Control Practice

A temporary or permanent measure that stabilizes soil by covering and/or binding soil particles in order to prevent soil particles from becoming detached by the forces of wind, water, or gravity and intercepts **sediment** in **runoff**.

Erosion Control Practice

A temporary or permanent measure that stabilizes soil by covering and/or binding soil particles in order to prevent soil particles from becoming detached by the forces of wind, water, or gravity.

Executive Director

The **Executive Director** of the Metropolitan Water Reclamation District of Greater Chicago.

Existing Detention Facility

A **detention facility** either permitted under the **Sewer Permit Ordinance** or constructed as of the effective date of this **Ordinance**.

Existing Development Plans List

A list of proposed **development** projects submitted by a **municipality** to the **District** for which the **municipality** has granted formal preliminary approval.

Existing Manufactured Home Park or Subdivision

A manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the **manufactured homes** are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final **site** grading or the pouring of concrete pads) is completed before the effective date of this **Ordinance**.

Expansion to an Existing Manufactured Home Park or Subdivision

The preparation of additional **sites** by the construction of facilities for servicing the lots on which the **manufactured homes** are to be affixed (including the installation of utilities, the construction of streets, and either final **site** grading or the pouring of concrete pads).

Facility Connection Authorization

Within the City of Chicago, an authorization for planned connection to **District** owned, operated, and maintained facilities located within the City of Chicago, and for impacts to **District** owned or leased property. Examples of **District** owned facilities may include (but are not limited to): **District** interceptor, **TARP** structure or **District** tunnel, **District** Lift Station or force main, **District** reservoir, a new or reconstructed outfall to a Chicago Area Waterway within the City of Chicago, new or reconstructed outfall to Lake Michigan from property located within the City of Chicago. Formerly known as a Sewer Connection Authorization. Refer to §703 of this **Ordinance** for more information.

Farmed Wetland

A **wetland** that is farmed currently or has been farmed within five years previous to the permit application date.

FEMA

Federal **E**mergency **M**anagement **A**gency. The federal agency whose primary mission is to reduce the loss of life and property and protect the nation from all hazards (including natural disasters, acts of terrorism, and other man-made disasters) by leading and supporting the nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation.

FIRM

Flood **I**nsurance **R**ate **M**ap. The current version of a map issued by **FEMA** that is an official community map on which **FEMA** has delineated both the special hazard areas and the risk premium zones applicable to a community together with any amendments, additions, revisions, or substitutions issued by **FEMA** at any time.

FIS

Flood **I**nsurance **S**tudy. The current version of a study of **flood** discharges and **flood** profiles for a community adopted and published by **FEMA**, together with any amendments, additions, revisions or substitutions issued by **FEMA** at any time. The **FIS** also includes its associated **FIRMs**.

Flood or Flooding

A general and temporary condition of partial or complete inundation of normally dry land areas from the unusual and rapid accumulation or **runoff** of surface waters from any source.

Flood Control Project

1) A **development** undertaken by either the **District** or a **municipality** to reduce the frequency and magnitude of **flood** events, including, but not limited to, reservoirs, floodwalls, levees, and channel conveyance improvements and excluding **detention facilities** or 2) a **development** undertaken by a public utility, as defined in the Illinois Public Utilities Act, that the **District** determines is necessary to protect critical utility infrastructure from **flood** events and that the **District** determines is consistent with the purposes of this **Ordinance**, as set forth in §103.

Flood Protection Areas

Regulatory floodplains, **regulatory floodways**, **riparian environments**, **wetlands**, and **wetland buffers**.

Floodplain

The area adjacent to and including a body of water where ground surface elevations are at or below a specified **flood** elevation.

Floodproof or Floodproofing

Additions, changes, or adjustments to **structures** or land that prevent the entry of **flood** water in order to protect property from **flood** damage.

Floodway

The channel and portion of the floodplain adjacent to a stream or watercourse that is needed to convey the base flood without cumulatively increasing the water surface elevation more than a tenth of a foot.

Floodway Conveyance

The measure of the flow carrying capacity of the **floodway** and is defined using Manning's equation as, $K = (1.49/n)AR^{2/3}$ where "n" is Manning’s roughness factor, "A" is the effective area of the cross-section, and "R" is ratio of the wetted area to the wetted perimeter.

Flow-Through Practices

Permanent **volume control practices** designed to treat **stormwater runoff** from **impervious areas** of a **development** after permanent **stabilization** is achieved.

FPE

Flood **P**rotection **E**levation. The highest **100-year flood elevation** plus two foot of freeboard, as determined in §601.9 of this **Ordinance**.

General Counsel

The General Counsel of the Metropolitan Water Reclamation District of Greater Chicago.

Green Infrastructure

Practices aimed to mimic functions of the hydrologic cycle including infiltration, interception, depression storage, evapotranspiration, and evaporation.

Groundwater

Subsurface water occupying the saturation zone, from which wells and springs are fed. Water found below the normal water table.

High Quality Isolated Wetland

Isolated wetlands that are of the highest value due to their uniqueness, scarcity, function, and/or value as determined by §603.9 of this **Ordinance**.

Highest Adjacent Grade

The highest natural elevation of the ground surface next to the proposed walls of a **building** prior to construction.

Hydraulically Equivalent Compensatory Storage

Compensatory storage that can be shown by hydrologic and hydraulic analysis to off-set the increase in **flood** elevations due to **development**.

Hydrology

The science of the behavior of water including its dynamics, composition, and distribution in the atmosphere, on the surface of the earth, and underground.

IDOT

Illinois **D**epartment **o**f **T**ransportation.

IEPA

Illinois **E**nvironmental **P**rotection **A**gency.

Illinois Pollution Control Board

A quasi-legislative and quasi-judicial body created under the Illinois Environmental Protection Act. The Illinois Pollution Control Board adopts environmental regulations and hears contested cases.

Illinois Recommended Standards for Sewage Works

The Illinois Recommended Standards for Sewage Works as included in the Illinois Administrative Code. 35 Ill. Adm. Code 370.

Illinois Urban Manual

This manual contains design guidance for a **development site** to meet this **Ordinance**'s performance standards for **erosion** and **sediment** control.

Impervious Area

Surfaces that do not readily allow for the penetration of rain into the ground, and include but are not limited to rooftops, paved areas and graveled areas. Areas that are designed to promote the infiltration of rainfall into the ground at rates at or above the infiltration rate of naturally vegetated areas (given applicable soil types), such as non-compacted gravel areas, porous/permeable pavement areas, and bioretention areas (rain gardens and bioswales, composed of an engineered soil mix) shall not be considered impervious.

Indirect Wetland Impact

A **development** activity that causes the **wetland hydrology** to fall below eighty percent (80%), or exceed one-hundred fifty percent (150%), of the existing condition **storm event runoff** volume to the **wetland** for the 2-year, 24-hour **storm event**.

Industrial Waste

The solids, liquid, or gaseous wastes resulting from any industrial, manufacturing, trade or business process or from the **development**, recovery or processing of natural resources.

Interest

The property interest or contractual interest, legal or equitable, directly or indirectly, in part or in full, and includes options to buy. In the case of a shareholder interest, the shareholder shall be deemed to have an interest if he owns or controls 5% or more of the shares.

Isolated Waters

All waters including **lakes**, ponds, streams, intermittent streams, and ephemeral pools that are not under the **Corps** jurisdiction. The limits of the **Isolated Waters** in **Cook County** extend to the **OHWM**.

Isolated Wetland

All **wetlands** that are not under the jurisdiction of the **Corps**.

Isolated Wetland Buffer

The vegetated area adjacent to **isolated wetlands** left open for the purpose of eliminating or minimizing adverse impacts to such areas.

Isolated Wetland Submittal

Submittal required under §305 of this **Ordinance**.

Jurisdictional Waters of the U.S.

All waters including **lakes**, ponds, streams, intermittent streams, and ephemeral pools that are under the jurisdiction of the **Corps**.

Jurisdictional Wetlands

All **wetlands** that are under the jurisdiction of the **Corps**.

Lake
A natural or artificial body of water encompassing a surface area of two or more acres that retains water throughout the year.

LOMA
Letter **o**f **M**ap **A**mendment. The official determination by **FEMA** that a specific **structure** or **parcel** of land is not in a **regulatory floodplain**. A **LOMA** amends the effective **FIRM**.

LOMC
Letter **O**f **M**ap **C**hange. A letter from **FEMA** which reflects an official revision to an effective **NFIP** map. **LOMC**s are issued in place of the physical revision and republication of the effective map.

LOMR
Letter **O**f **M**ap **R**evision. A letter from **FEMA** that revises **BFEs**, **flood** insurance rate zones, **flood** boundaries, or **floodway** as shown on an effective **FIRM**.

LOMR-F
Letter **O**f **M**ap **R**evision Based on **Fi**ll. A letter from **FEMA** which officially revises an effective **NFIP** map. A **LOMR-F** provides **FEMA**'s determination concerning whether a **structure** or **parcel** has been elevated on fill above the **BFE** and excluded from the **Special Flood Hazard Area**.

Long Term O&M Program
Long **T**erm **O**peration and **M**aintenance **P**rogram. An ongoing program that a **satellite entity** develops and implements to reduce **SSOs** and **BB**s including but not limited to removing I/I sources, addressing deficiencies in its sewer system, maintaining system capacity, and preventing catastrophic system failures.

Lowest Entry Elevation
The elevation at which water can enter a **building** through any non-water tight opening such as a doorway threshold, windowsill, or **basement** window well.

Lowest Floor
The **lowest floor** of the lowest enclosed area (including **basement**). An unfinished or **flood** resistant enclosure, used solely for parking of vehicles, **building** access, or storage in an area other than a **basement** area is not considered a **building**'s **lowest floor**; provided, that such enclosure is not built so as to render the **structure** in violation of the applicable non-elevation design requirement of the Code of Federal Regulations (44 CFR 60.3).

Maintenance
The action required to preserve the original function and prevent failure of systems, which include but are not limited to, **sewage** systems, **major stormwater systems**, constructed **wetlands**, or **green infrastructure**. [*Compare* **maintenance** *with* **maintenance activities**, **development***, and* **demolition***.*]

Maintenance Activities
In kind replacement, restoration, or repair of existing infrastructure, pavement, or facilities including, but not limited to, roadways and parking lots such that they will perform the same functions for which they were originally designed and constructed. [*Compare* **maintenance**

activities *with* **maintenance**, **development***, and* **demolition**.]

Major Stormwater System
That portion of a stormwater system needed to store and convey flows for the 100-year storm event.

Manual of Procedures
The **District**'s Manual of Procedures for the Administration of the Sewer Permit Ordinance as amended November 5, 1988.

Manufactured Home
A **building** that is transportable in one or more sections, built on a permanent chassis, and designated for use with or without a permanent foundation when connected to the required utilities. The term **manufactured home** includes park trailers, travel trailers, and other similar vehicles placed on a **site** for more than 180 consecutive days.

Manufactured Home Park or Subdivision
A **parcel** or **contiguous parcels** of land divided into two or more **manufactured home** lots.

Material Change
Any deviation from the approved plans or specifications accompanying an application for which a **Watershed Management Permit** has been issued under this **Ordinance**, that would affect the **runoff**, capacity, flow, or operation of sewerage and/or **major stormwater systems** constructed under said **Watershed Management Permit**.

Minor Stormwater System
All infrastructure including curb, gutter, culverts, roadside ditches and swales, **storm sewers**, tiles, subsurface drainage systems, and other practices intended to convey or capture **stormwater runoff** from **storm events** less than a 100-year **storm event**.

Multi-County Municipality
A **municipality** containing corporate area within both **Cook County** and an Illinois county located **contiguously** adjacent to **Cook County**.

Multi-Family Residential
Residential **parcel** where any **building** contains three (3) dwelling units or more. [*Compare* **multi-family residential** *with* **residential subdivision**.]

Municipality
A local government, including a city, village, town, or Cook County. The term shall not be understood to include a township, school district, park district, or sanitary district.

Native Planting Conservation Area
Area planted with native deep-rooted vegetation, as approved by the **District**, and maintained in perpetuity to address **unrestricted flow** areas of a **development site**.

New Construction

For the purpose of determining insurance rates, **structures** for which the **start of construction** commenced on or after the effective date of an initial **FIRM** or after December 31, 1974, whichever is later, and included any subsequent improvements to such **structures**. For the purpose of **floodplain** management, **new construction** means **structures** for which the **start of construction** commenced on or after the effective date of the **floodplain** management regulation adopted by a community and includes any subsequent improvements to such **structures**.

New Impervious Area

Impervious areas that result from **development** or **redevelopment** including new **structures** or **buildings** associated with **development**, new impervious surfaces, and impervious surfaces that are being replaced as part of **redevelopment**.

New Manufactured Home Park or Subdivision

A **manufactured home park** or subdivision for which the construction of facilities for servicing homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final **site** grading or the pouring of concrete pads) is completed on or after the effective date of this **Ordinance**.

NFIP

National **F**lood **I**nsurance **P**rogram. The requirements of the **NFIP** are codified in Title 44 of the Code of Federal Regulations.

NONC

Notice **o**f **N**on-**C**ompliance**.** Notice issued to a **satellite entity** by the **District** for an apparent infraction of the Infiltration/Inflow Control Program described in Article 8 of this **Ordinance**.

Non-Residential

Land uses other than **residential subdivisions**, **multi-family residential**, **right-of-way**, or **open space**. **Non-residential** land use may include, but is not limited to, commercial land use and industrial land use.

Non-Qualified Development

Redevelopment area excluded from the **allowable release rate** calculation specified in §504.3 and **detention facility** volume calculation specified in §504.7 of this **Ordinance**.

Non-Qualified Sewer Construction

Non-qualifying sewer construction is defined in §701.2 of this **Ordinance**.

NOV

Notice **o**f **V**iolation. Notice given to a **permittee**, **co-permittee**, and/or any other **person** responsible for an apparent violation of this **Ordinance**.

NPDES

The **N**ational **P**ollutant **D**ischarge **E**limination **S**ystem.

NRCS

The United States Department of Agriculture **N**atural **R**esources **C**onservation **S**ervice.

NWI

National **W**etland **I**nventory. The **wetland** mapping program created by the U.S. Fish and Wildlife Service to provide information on the characteristics, extent, and status of the nation's **wetlands**, deepwater habitats, and other wildlife habitats.

Offsite Detention Facility

A manmade **structure** providing temporary storage of **stormwater runoff** intended to mitigate hydrologic impacts of **development** elsewhere in the **watershed**.

Offsite Volume Control Practices

Permanent practices designed to capture, retain, and infiltrate **stormwater runoff** from **impervious areas** of a **development** located elsewhere in the **subwatershed**.

OHWM

Ordinary **H**igh **W**ater **M**ark. The point on a bank or shore at which the presence and movement of surface waters is continuous, leaving a distinctive mark. The mark may be caused by **erosion**, destruction or prevention of terrestrial vegetation, a predominance of hydrophytic vegetation, or other recognized factors.

Open Space

Pervious land to be retained as pervious land which is not part of a larger development. Open space may include sidewalk, bike path, nature or walking trail **development** less than or equal to fourteen feet in width. [*Compare* **open space** *with* **right-of-way**.]

Ordinance

The Watershed Management Ordinance.

Other Wastes

All decayed wood, sawdust, shavings, bark, lime, refuse, ashes, garbage, offal, oil, tar, chemicals, and all other substances except sewage and industrial wastes.

Outfall

The end point of any **storm**, **sanitary**, or **combined sewer**, providing a point source discharge into a defined **waterway**, or Lake Michigan. **Outfalls** do not include culverts or open conveyances systems connecting two segments of a **waterway**. Outfalls do not include private single-family home drains.

Owner

The record title holder or a beneficiary of a land trust which is the record title holder, and includes singular and plural; if the **owner** is other than an individual, the term includes beneficiaries, agents, shareholders, officers, and directors.

Ownership

The holding of record title or any beneficial **interest.**

OWR

The Illinois Department of Natural Resources **O**ffice of **W**ater **R**esources.

Parcel

Contiguous land area under single **ownership** or control, under an affidavit of **ownership**, or under a single legal description on record with the Cook County Recorder of Deeds Office.

Permittee

Any **municipality**, municipal corporation, sanitary district, utility company, township government, or any other governmental body required to jointly sign a **Watershed Management Permit** application. [*Compare* **permittee** *with* **co-permittee** and **sole permittee**].

Person

Any individual, partnership, firm, school, district, company, corporation, municipal corporation, association, joint stock company, trust, estate, unit of local government, sanitary district, special taxing district, school district, public utility, political subdivision, county agency, state agency, federal agency, or any other legal entity, or **owner**, or any legal representative, agent, or assign thereof.

Professional Engineer

A **person** licensed under the laws of the State of Illinois to practice professional engineering.

Professional Engineering

The application of science to the design of engineering systems and facilities using the knowledge, skills, ability, and professional judgment developed through professional engineering education, training, and experience.

Professional Land Surveyor

A **person** licensed under the laws of the State of Illinois to practice land surveying.

PSP

Private **S**ector **P**rogram. An ongoing program that a **satellite entity** develops and implements to identify and remove I/I from privately owned sources.

Public Flood Easement

An easement acceptable to the appropriate jurisdictional body that meets the regulation of the **OWR**, the **District**, and the **municipality**, that provides legal assurances that all areas subject to **flooding** in the created backwater of the **development** will remain open to allow **flooding**.

Qualified Sewer Construction

All public and private new sewers and new sewer connections, exterior to a **building envelope**, including sewer repair and sewer replacement. See §701 of this **Ordinance** for a complete list.

Recommended Standards for Wastewater Facilities

The current edition of the **Recommended Standards for Wastewater Facilities,** also known as the Ten States Standards, as published by the Great Lakes—Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

Record Drawings

Drawings prepared, signed, and sealed by a **professional engineer** or **professional land surveyor** representing the final "as-built" record of the actual in-place elevations, location of **structures**, and topography.

Redevelopment

Any human-induced activity or change to an existing developed property (including but not limited to, grading, paving, excavation, dredging, fill, or mining; alteration, subdivision, change in land use or practice; **building**; or storage of equipment or materials) undertaken by private or public entities that affects the volume, flow rate, drainage pattern, or composition of the **site stormwater runoff** on the previously developed land. The term shall not be understood to include **maintenance**.

Regulatory Floodplain

The **floodplain** as determined by the **BFE** used as the basis for regulation in this **Ordinance**.

Regulatory Floodway

Floodway under the jurisdiction of the Illinois Department of Natural Resources (17 Ill. Adm. Code 1700.30), which consists of portions of the **floodplain** depicted as **floodway** on maps recognized by **OWR**.

Residential Subdivision

Residential **parcel** that is planned to be subdivided for **development**, and where each sub-parcel contains a **building** with less than three (3) dwelling units. [*Compare* **residential subdivision** *with* **multi-family residential** and **single-family home**].

Respondent

Permittee, **co-permittee**, and/or any other **person** responsible for an apparent violation of this **Ordinance**.

Retention-Based Practices

Permanent **volume control practices** designed to capture, retain, infiltrate and treat **stormwater runoff** from **impervious areas** of a **development** after permanent **stabilization** is achieved.

Right-of-Way

Public **right-of-way** dedicated as of the effective date of this **Ordinance** including features such as roads and sidewalks. [*Compare* **right-of-way** *with* **open space**.]

Riparian Environment

The vegetated area between aquatic and **upland** ecosystems adjacent to a **waterway** or body of water that provides **flood** management, habitat, and water quality enhancement or other amenities dependent upon the proximity to water.

Runoff

The water from melting snow and/or precipitation falling within a **watershed** drainage area that exceeds the infiltration capacity of the soil of that basin.

Sanitary Sewer

Sewers intended for the conveyance of wastewater. [*Compare* **sanitary sewer** *with* **storm sewer** and **combined sewer**].

Satellite Entity

Any municipality, municipal corporation, township government or other governmental body, sanitary district, or utility company that owns and/or operates a public sanitary sewer system, including any successors or assigns of those entities, that discharges directly and/or indirectly to the **District's** facilities.

Sediment

The suspended soil particles that are transported after **erosion** has occurred.

Sedimentation

The process when the velocity of wind or water is slowed sufficiently to allow the suspended soil particles to settle.

Sediment Basin

A **structure** or area that allows for the **sedimentation** of **stormwater runoff**.

Sediment Control Practice

A **structure** that is designed to intercept **sediment** in **runoff**.

Separate Sewer Area

An area where **stormwater runoff** is intended to be collected and conveyed in a **separate sewer**, pipe and/or ditch system to a point of discharge in a receiving natural or man-made **waterway** or other **stormwater facility**. This regulatory limit was established in the past to limit further expansion of areas served by **combined sewers**. This area does not represent the actual effective boundaries between combined and separate sewer sheds. Consult local sewer system atlas information for that level of detail. [*Compare* **separate sewer area** *with* **combined sewer *area***].

Service Sewer

A sewer pipe constructed on private property, except for street crossing, that receives flow from a single **building** and connects to a sewer main or lateral.

Sewage

The water-carried human wastes or a combination of water-carried waters from residences, business **buildings**, institutions and industrial establishments, together with such ground, surface, storm or **other wastes** as may be present.

Sewage and Waste Control Ordinance

The **District's** current **Sewage and Waste Control Ordinance**.

Sewer Permit Ordinance

The **District's Sewer Permit Ordinance** as amended in July of 1999.

Sewerage System Permit

A permit required under the **District**'s **Sewer Permit Ordinance.**

Silt Fence

A temporary **sediment** control barrier consisting of entrenched geotextile filtering fabric attached to supporting posts that is designed to prevent **sediment**-laden **runoff** from leaving a **site**. The application of a **silt fence** is limited to containment of sheet flow **runoff** from small **drainage areas**.

Single-Family Home

Residential **parcel** containing less than three (3) dwelling units. **Single-family home parcels** subdivided after the effective date of this **Ordinance** are considered as **residential subdivision**. [*Compare* **single family home** *with* **residential subdivision** and **multi-family residential**].

Site

Parcel or **parcels** associated with a **development** or **redevelopment**.

Site Constraint

Condition on a **site** that limits the use of **retention-based practices,** such as contaminated soils, high **groundwater**, **wetlands**, **riparian environments**, or **floodway**. New **development** that is considered a **site constraint** includes, but is not limited to, gas stations, chemical storage facilities, and conservation areas. Poor soils and proposed utility conflicts are not considered **site constraints**.

Sole Permittee

A **co-permittee** applying for a **Watershed Management Permit** without a **permittee**. A **sole permittee** is solely and completely responsible for the perpetual operation and **maintenance** of all site infrastructure, including the **sanitary sewer systems,** as approved under the **Watershed Management Permit**. See §301.1.B(1) of this **Ordinance** for a complete list requirements. [*Compare* **sole permittee** *with* **permittee** and **co-permittee**].

Special Flood Hazard Area

An area having special **flood**, mudslide, mudflow, or flood-related **erosion** hazards and which is identified on a **FIRM** as Zone A, AO, A1-30, AE, A99, AH, VO, V1-30, VE, V, M, or E.

SSA

Sewer **S**ummit **A**greement provides guidelines for achieving final compliance with sewer rehabilitation requirements acceptable to **IEPA**, **USEPA**, municipal conferences and the **District**. The goals of the **SSA** are to prevent water pollution and eliminate **BBs** and adverse surcharging conditions that cause health hazards and financial losses**.**

SSO

Sanitary Sewer Overflow. Any release or diversion of untreated sanitary wastewater from the sanitary sewer system to a surface water, storm sewer or storm ditch or the ground due to circumstances including but not limited to rain, snow melt, power outage, collapsed sewers, equipment failure, widespread flooding and/or pumping

Stabilization or Stabilized

Establishment of vegetative cover, riprap, or other means that minimizes **erosion** on **disturbed areas**.

Standard Isolated Wetland

All **isolated wetlands** other than **high quality isolated wetlands**.

Standard Specifications for Water & Sewer Construction in Illinois

The current edition of the Standard Specifications for Water & Sewer Construction in Illinois published by the Illinois Society of Professional Engineers.

Start of Construction

The date the **building** or **development** permit was issued, provided the actual **start of construction**, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a **structure** on a **site**, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a **manufactured home** on a foundation. For **substantial improvements**, the actual **start of construction** means the first alteration of any wall, ceiling, floor, or other structural part of a **building** whether or not that alteration affects the external dimensions of the **building**.

Storm Event

The frequency rainfall event as published in **Bulletin 70**.

Storm Sewer

A sewer intended for the conveyance of only **stormwater runoff**. [*Compare* **storm sewer** *with* **combined sewer** and **sanitary sewer**].

Stormwater

Precipitation that falls to the ground that does not naturally infiltrate into the subsurface soil.

Stormwater Facility

Structures and measures both natural and artificial which serve as a means of draining surface and subsurface water from land including, but not limited to, ditches, channels, conduits, bridges, culverts, levees, ponds, natural and man-made impoundments, **wetlands**, **wetland buffers**, **riparian environment**, tile, swales, **storm sewers**, and **waterways**.

Structure

A **structure** is anything that is erected or constructed on or below ground including, but not limited to, **buildings**, **manufactured homes**, **accessory structures**, fences, sheds, tanks, **dams**, sewers, manholes, drop shafts, constructed channels, **outfalls**, parking lots, driveways, roads, sidewalks, and concrete patios.

Substantial Damage

Damage of any origin sustained by a **building** whereby the cost of restoring the **building** to its before damaged condition would equal or exceed 50 percent of the market value of the **building** before the damage occurred.

Substantial Improvement

Determined by the local **municipality** in accordance with **NFIP** regulation. **FEMA** defines substantial improvement as "Any repair, reconstruction, rehabilitation, addition, or other improvement of a **building**, the cost of which improvement equals or exceeds, individually or in the aggregate, fifty percent (50%) of the fair market value of the **building**, determined from the equalized assessed value of the **building** before the **start of construction** of the improvement. This term includes **building**s which have incurred "**substantial damage**", regardless of the actual repair work performed." The term "cost of improvement" includes the market value of volunteer labor and donated materials. The term "cost of improvement" does not, however, include either (a) any project for improvement of a **building** to correct existing violations of state or local health, sanitary, or safety code specifications that have been identified by the local code enforcement official and that are the minimum necessary to assure safe living conditions or (b) any alteration of a historic **building** or a historic district that will not preclude the **building**'s continued designation as a historic **building**.

Subwatershed

Major **watershed** division of a **watershed planning area** as identified in the **District**'s Detailed Watershed Plans.

Swink and Wilhelm Mean Coefficient of Conservatism (ĉ)

The mean coefficient of conservatism (ĉ) in an inventory group calculated by the sum of all coefficients in an inventory unit divided by the number of species (N).

Swink and Wilhelm Floristic Quality Index (FQI)

The index derived from floristic inventory data. The index is the arithmetic product of the average coefficient of conservatism (ĉ) and the square-root of species richness (√N) of an inventory unit.

TARP

The **District**'s **T**unnel **A**nd **R**eservoir **P**lan including all associated **structures** and appurtenances.

TGM

Technical **G**uidance **M**anual. A manual prepared in conjunction with this **Ordinance** that provides technical information and guidance on how to comply with the provisions of this **Ordinance**, and as amended from time to time.

Tributary Area

All land drained by or contributing water to the same stream, **lake**, or **stormwater facility**, or which drains to a common point.

Underdrain

A below grade pipe containing openings that allow the drainage of **stormwater** from overlying soils, gravel, sand, aggregate, and other similar media. **Underdrains** include, but are not limited to, field tiles, drain tiles, and open jointed pipes.

Unrestricted Flow

Stormwater runoff from a **development** which is not directed to the required **detention facility** is unrestricted or uncontrolled release or flow. The areas generating unrestricted flow are referred to as unrestricted or uncontrolled release rate areas.

Upland

Terrain lying above the level where water flows or where flooding occurs.

Upstream Tributary Flow

Stormwater runoff or **groundwater** flows from **tributary areas** upstream of a **development site**. **Upstream tributary flows** can be **bypass flows**.

USEPA
United States Environmental Protection Agency

Variance
A limited grant of relief by the **District** from the term(s) or condition(s) of this **Ordinance**.

Volume Control Practices
Permanent practices designed to capture, retain, and infiltrate **stormwater runoff** from **impervious areas** of a **development** after permanent **stabilization** is achieved.

Volume Control Storage
The first inch of **runoff** from the **impervious area** of **development** on the **site**.

Watershed
Tributary areas discharging to a common point.

Watershed Management Permit
A permit established by this **Ordinance** that is issued by the **District** prior to the approval of a **building** or construction permit by the appropriate unit of local government. The issuance of a **Watershed Management Permit** signifies that the proposed **development** is in compliance with the provisions of this **Ordinance**.

Watershed Planning Area
The area considered in a specific **DWP** and depicted in Appendix E of this **Ordinance**.

Water Reclamation Facility
Facility designed to treat **sewage**.

Water Resource Benefit
A decrease in **flood** elevations, a reduction in **flood** damages to **structures** upstream or downstream of the **development site**, a reduction in peak flow rates, and/or enhancement of existing water-related environmental resources created by the **development** which is greater than the minimum **Ordinance** requirements.

Waterway
Navigable body of water such as a stream, creek, canal, channel, or river.

Wetlands
Areas which are inundated or saturated by surface or ground water (**hydrology**) at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation (hydrophytes) typically adapted for life in saturated soil conditions (hydric soils). **Wetlands** generally include swamps, marshes, bogs, and similar areas.

Wetland Buffer
The vegetated area adjacent to **wetlands** left open for the purpose of eliminating or minimizing adverse impacts to such areas.

Wetland Impact

Wetlands that are directly or indirectly disturbed or otherwise adversely affected, whether temporarily or permanently, by filling, excavation, **flooding**, or drainage which results from implementation of a **development** activity.

Wetland Mitigation

The process of offsetting wetland impacts through the restoration, creation, enhancement, and preservation of wetlands.

Wetland Mitigation Bank

A **site** where **wetlands** are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for authorized impacts. In general, a mitigation bank sells compensatory mitigation credits (acres) to the **co-permittee**(s), whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor.

Wetland Specialist

A **person** having skill in the art and science of identifying, delineating, and assessing **wetlands**.

TGM Appendix A Revision Table

No.	Revision Description	Date
0	Original TGM and WMO	5/1/2014
1	July 10, 2014 WMO Amendment definitions	8/1/2015
2	February 15, 2018 WMO Amendment definitions	2/15/2018

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
ALSIP	170055	8/19/2008	17031C0609J
		8/19/2008	17031C0617J
		8/19/2008	17031C0628J
		8/19/2008	17031C0636J
		8/19/2008	17031C0637J
		8/19/2008	17031C0638J
		8/19/2008	17031C0639J
ARLINGTON HEIGHTS	170056	8/19/2008	17031C0044J
		8/19/2008	17031C0063J
		8/19/2008	17031C0064J
		8/19/2008	17031C0182J
		8/19/2008	17031C0184J
		8/19/2008	17031C0192J
		8/19/2008	17031C0201J
		8/19/2008	17031C0202J
		8/19/2008	17031C0203J
		8/19/2008	17031C0204J
		8/19/2008	17031C0211J
		8/19/2008	17031C0212J
BARRINGTON	170057	8/19/2008	17031C0020J
		8/19/2008	17031C0038J
BARRINGTON HILLS	170058	8/19/2008	17031C0015J
		8/19/2008	17031C0020J
		8/19/2008	17031C0155J
		8/19/2008	17031C0156J
		8/19/2008	17031C0157J
BARTLETT	170059	8/19/2008	17031C0163J
		8/19/2008	17031C0164J
		8/19/2008	17031C0168J
		8/19/2008	17031C0305J
BEDFORD PARK	171007	8/19/2008	17031C0487J
		8/19/2008	17031C0488J
		8/19/2008	17031C0489J
		8/19/2008	17031C0606J
BELLWOOD	170061	8/19/2008	17031C0369J
		8/19/2008	17031C0388J
		8/19/2008	17031C0457J
		8/19/2008	17031C0476J
BENSENVILLE	170200	8/19/2008	17031C0358J
BERKELEY	171039	8/19/2008	17031C0369J
		8/19/2008	17031C0456J
BERWYN	171036	8/19/2008	17031C0483J
		8/19/2008	17031C0484J
BLUE ISLAND	170064	8/19/2008	17031C0637J
		8/19/2008	17031C0639J
		8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0645J
BRIDGEVIEW	170065	8/19/2008	17031C0489J
		8/19/2008	17031C0602J
		8/19/2008	17031C0606J
		8/19/2008	17031C0608J
BROADVIEW	170067	8/19/2008	17031C0476J
		8/19/2008	17031C0477J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
BROOKFIELD	170066	8/19/2008	17031C0478J
		8/19/2008	17031C0479J
		8/19/2008	17031C0486J
		8/19/2008	17031C0487J
BUFFALO GROVE	170068	8/19/2008	17031C0063J
		8/19/2008	17031C0064J
BURBANK	170069	8/19/2008	17031C0606J
		8/19/2008	17031C0607J
BURNHAM	170070	8/19/2008	17031C0664J
		8/19/2008	17031C0668J
		8/19/2008	17031C0669J
BURR RIDGE	170071	8/19/2008	17031C0466J
		8/19/2008	17031C0468J
		8/19/2008	17031C0469J
		8/19/2008	17031C0581J
		8/19/2008	17031C0582J
CALUMET CITY	170072	8/19/2008	17031C0664J
		8/19/2008	17031C0668J
		8/19/2008	17031C0669J
		8/19/2008	17031C0752J
		8/19/2008	17031C0754J
		8/19/2008	17031C0756J
		8/19/2008	17031C0757J
		8/19/2008	17031C0758J
		8/19/2008	17031C0759J
CALUMET PARK	170073	8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0645J
CHICAGO HEIGHTS	170075	8/19/2008	17031C0742J
		8/19/2008	17031C0743J
		8/19/2008	17031C0744J
		8/19/2008	17031C0763J
		8/19/2008	17031C0806J
		8/19/2008	17031C0807J
		8/19/2008	17031C0826J
CHICAGO RIDGE	170076	8/19/2008	17031C0606J
		8/19/2008	17031C0607J
		8/19/2008	17031C0608J
		8/19/2008	17031C0609J
CHICAGO	170074	8/19/2008	17031C0214J
		8/19/2008	17031C0218J
		8/19/2008	17031C0219J
		8/19/2008	17031C0243J
		8/19/2008	17031C0244J
		8/19/2008	17031C0265J
		8/19/2008	17031C0270J
		8/19/2008	17031C0356J
		8/19/2008	17031C0357J
		8/19/2008	17031C0358J
		8/19/2008	17031C0359J
		8/19/2008	17031C0376J
		8/19/2008	17031C0378J
		8/19/2008	17031C0382J
		8/19/2008	17031C0385J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
CHICAGO	170074	8/19/2008	17031C0386J
		8/19/2008	17031C0387J
		8/19/2008	17031C0401J
		8/19/2008	17031C0402J
		8/19/2008	17031C0404J
		8/19/2008	17031C0410J
		8/19/2008	17031C0415J
		8/19/2008	17031C0416J
		8/19/2008	17031C0417J
		8/19/2008	17031C0418J
		8/19/2008	17031C0419J
		8/19/2008	17031C0438J
		8/19/2008	17031C0440J
		8/19/2008	17031C0484J
		8/19/2008	17031C0491J
		8/19/2008	17031C0492J
		8/19/2008	17031C0503J
		8/19/2008	17031C0504J
		8/19/2008	17031C0506J
		8/19/2008	17031C0507J
		8/19/2008	17031C0508J
		8/19/2008	17031C0526J
		8/19/2008	17031C0528J
		8/19/2008	17031C0529J
		8/19/2008	17031C0540J
		8/19/2008	17031C0545J
		8/19/2008	17031C0628J
		8/19/2008	17031C0636J
		8/19/2008	17031C0637J
		8/19/2008	17031C0645J
		8/19/2008	17031C0655J
		8/19/2008	17031C0658J
		8/19/2008	17031C0659J
		8/19/2008	17031C0660J
		8/19/2008	17031C0661J
		8/19/2008	17031C0662J
		8/19/2008	17031C0663J
		8/19/2008	17031C0664J
		8/19/2008	17031C0668J
		8/19/2008	17031C0669J
		8/19/2008	17031C0670J
CICERO	17077	8/19/2008	17031C0484J
		8/19/2008	17031C0503J
COUNTRY CLUB HILLS	170078	8/19/2008	17031C0728J
		8/19/2008	17031C0729J
		8/19/2008	17031C0736J
		8/19/2008	17031C0737J
		8/19/2008	17031C0467J
COUNTRYSIDE	170079	8/19/2008	17031C0469J
		8/19/2008	17031C0486J
		8/19/2008	17031C0488J
CRESTWOOD	170080	8/19/2008	17031C0617J
		8/19/2008	17031C0619J
		8/19/2008	17031C0636J
		8/19/2008	17031C0638J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
CRESTWOOD	170080	8/19/2008	17031C0639J
DEERFIELD	170361	8/19/2008	17031C0069J
		8/19/2008	17031C0088J
		8/19/2008	17031C0089J
DES PLAINES	170081	8/19/2008	17031C0208J
		8/19/2008	17031C0209J
		8/19/2008	17031C0212J
		8/19/2008	17031C0214J
		8/19/2008	17031C0216J
		8/19/2008	17031C0217J
		8/19/2008	17031C0218J
		8/19/2008	17031C0219J
		8/19/2008	17031C0236J
		8/19/2008	17031C0238J
		8/19/2008	17031C0357J
		8/19/2008	17031C0376J
DIXMOOR	170082	8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0731J
DOLTON	170083	8/19/2008	17031C0644J
		8/19/2008	17031C0663J
		8/19/2008	17031C0664J
		8/19/2008	17031C0732J
		8/19/2008	17031C0751J
		8/19/2008	17031C0752J
EAST HAZEL CREST	170085	8/19/2008	17031C0733J
		8/19/2008	17031C0734J
ELGIN	170087	8/19/2008	17031C0142J
		8/19/2008	17031C0144J
		8/19/2008	17031C0155J
		8/19/2008	17031C0161J
		8/19/2008	17031C0163J
		8/19/2008	17031C0305J
ELK GROVE VILLAGE	170088	8/19/2008	17031C0193J
		8/19/2008	17031C0194J
		8/19/2008	17031C0211J
		8/19/2008	17031C0213J
		8/19/2008	17031C0214J
		8/19/2008	17031C0218J
		8/19/2008	17031C0331J
		8/19/2008	17031C0332J
		8/19/2008	17031C0351J
ELMWOOD PARK	170089	8/19/2008	17031C0387J
EVANSTON	170090	8/19/2008	17031C0253J
		8/19/2008	17031C0255J
		8/19/2008	17031C0260J
		8/19/2008	17031C0265J
		8/19/2008	17031C0270J
EVERGREEN PARK	170733	8/19/2008	17031C0628J
FLOSSMOOR	170091	8/19/2008	17031C0737J
		8/19/2008	17031C0739J
		8/19/2008	17031C0741J
		8/19/2008	17031C0742J
		8/19/2008	17031C0743J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
FLOSSMOOR	170091	8/19/2008	17031C0744J
FORD HEIGHTS	170084	8/19/2008	17031C0763J
		8/19/2008	17031C0764J
		8/19/2008	17031C0768J
		8/19/2008	17031C0826J
		8/19/2008	17031C0827J
FOREST PARK	170092	8/19/2008	17031C0389J
		8/19/2008	17031C0477J
FOREST VIEW	170093	8/19/2008	17031C0484J
		8/19/2008	17031C0491J
		8/19/2008	17031C0492J
FRANKLIN PARK	170094	8/19/2008	17031C0358J
		8/19/2008	17031C0359J
		8/19/2008	17031C0366J
		8/19/2008	17031C0367J
		8/19/2008	17031C0378J
		8/19/2008	17031C0386J
GLENCOE	170095	8/19/2008	17031C0093J
		8/19/2008	17031C0094J
		8/19/2008	17031C0113J
		8/19/2008	17031C0231J
		8/19/2008	17031C0232J
		8/19/2008	17031C0251J
GLENVIEW	170096	8/19/2008	17031C0207J
		8/19/2008	17031C0209J
		8/19/2008	17031C0226J
		8/19/2008	17031C0227J
		8/19/2008	17031C0228J
		8/19/2008	17031C0229J
		8/19/2008	17031C0231J
		8/19/2008	17031C0233J
		8/19/2008	17031C0234J
		8/19/2008	17031C0236J
		8/19/2008	17031C0237J
		8/19/2008	17031C0241J
GLENWOOD	170097	8/19/2008	17031C0742J
		8/19/2008	17031C0761J
		8/19/2008	17031C0762J
		8/19/2008	17031C0763J
		8/19/2008	17031C0764J
GOLF	170098	8/19/2008	17031C0233J
		8/19/2008	17031C0234J
		8/19/2008	17031C0241J
		8/19/2008	17031C0242J
HANOVER PARK	170099	8/19/2008	17031C0168J
		8/19/2008	17031C0169J
		8/19/2008	17031C0307J
HARVEY	170100	8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0731J
		8/19/2008	17031C0732J
		8/19/2008	17031C0734J
		8/19/2008	17031C0751J
HARWOOD HEIGHTS	170101	8/19/2008	17031C0385J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
HAZEL CREST	170102	8/19/2008	17031C0729J
		8/19/2008	17031C0733J
		8/19/2008	17031C0734J
		8/19/2008	17031C0737J
HICKORY HILLS	170103	8/19/2008	17031C0601J
		8/19/2008	17031C0602J
		8/19/2008	17031C0603J
		8/19/2008	17031C0604J
		8/19/2008	17031C0606J
		8/19/2008	17031C0608J
HILLSIDE	170104	8/19/2008	17031C0369J
		8/19/2008	17031C0456J
		8/19/2008	17031C0457J
HINSDALE	170105	8/19/2008	17031C0458J
		8/19/2008	17031C0466J
		8/19/2008	17031C0467J
		8/19/2008	17031C0468J
		8/19/2008	17031C0469J
HODGKINS	170106	8/19/2008	17031C0469J
		8/19/2008	17031C0486J
		8/19/2008	17031C0487J
		8/19/2008	17031C0488J
		8/19/2008	17031C0489J
		8/19/2008	17031C0582J
		8/19/2008	17031C0601J
HOFFMAN ESTATES	170107	8/19/2008	17031C0155J
		8/19/2008	17031C0157J
		8/19/2008	17031C0158J
		8/19/2008	17031C0159J
		8/19/2008	17031C0161J
		8/19/2008	17031C0162J
		8/19/2008	17031C0166J
		8/19/2008	17031C0167J
		8/19/2008	17031C0176J
		8/19/2008	17031C0178J
		8/19/2008	17031C0179J
		8/19/2008	17031C0186J
		8/19/2008	17031C0187J
		8/19/2008	17031C0188J
		8/19/2008	17031C0189J
		8/19/2008	17031C0191J
HOMETOWN	171040	8/19/2008	17031C0630J
HOMEWOOD	170109	8/19/2008	17031C0729J
		8/19/2008	17031C0733J
		8/19/2008	17031C0734J
		8/19/2008	17031C0737J
		8/19/2008	17031C0741J
		8/19/2008	17031C0742J
INDIAN HEAD PARK	170110	8/19/2008	17031C0468J
		8/19/2008	17031C0469J
INVERNESS	170111	8/19/2008	17031C0020J
		8/19/2008	17031C0038J
		8/19/2008	17031C0039J
		8/19/2008	17031C0157J

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
INVERNESS	170111	8/19/2008	17031C0176J
		8/19/2008	17031C0177J
		8/19/2008	17031C0178J
		8/19/2008	17031C0179J
JUSTICE	170112	8/19/2008	17031C0488J
		8/19/2008	17031C0489J
		8/19/2008	17031C0601J
		8/19/2008	17031C0602J
KENILWORTH	170113	8/19/2008	17031C0253J
		8/19/2008	17031C0255J
LA GRANGE	170114	8/19/2008	17031C0459J
		8/19/2008	17031C0467J
		8/19/2008	17031C0478J
		8/19/2008	17031C0486J
LA GRANGE PARK	170115	8/19/2008	17031C0459J
		8/19/2008	17031C0476J
		8/19/2008	17031C0478J
LANSING	170116	8/19/2008	17031C0754J
		8/19/2008	17031C0756J
		8/19/2008	17031C0758J
		8/19/2008	17031C0759J
		8/19/2008	17031C0762J
		8/19/2008	17031C0766J
		8/19/2008	17031C0767J
LEMONT	170117	8/19/2008	17031C0567J
		8/19/2008	17031C0569J
		8/19/2008	17031C0579J
		8/19/2008	17031C0583J
		8/19/2008	17031C0586J
		8/19/2008	17031C0587J
		8/19/2008	17031C0588J
		8/19/2008	17031C0589J
		8/19/2008	17031C0591J
		8/19/2008	17031C0593J
LINCOLNWOOD	171001	8/19/2008	17031C0244J
		8/19/2008	17031C0265J
		8/19/2008	17031C0382J
		8/19/2008	17031C0401J
		8/19/2008	17031C0402J
LYNWOOD	170119	8/19/2008	17031C0762J
		8/19/2008	17031C0764J
		8/19/2008	17031C0766J
		8/19/2008	17031C0767J
		8/19/2008	17031C0768J
		8/19/2008	17031C0769J
		8/19/2008	17031C0831J
		8/19/2008	17031C0832J
LYONS	170120	8/19/2008	17031C0479J
		8/19/2008	17031C0483J
		8/19/2008	17031C0487J
		8/19/2008	17031C0491J
MARKHAM	175169	8/19/2008	17031C0726J
		8/19/2008	17031C0727J
		8/19/2008	17031C0729J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
MARKHAM	175169	8/19/2008	17031C0731J
		8/19/2008	17031C0732J
		8/19/2008	17031C0733J
		8/19/2008	17031C0734J
MATTESON	170123	8/19/2008	17031C0718J
		8/19/2008	17031C0719J
		8/19/2008	17031C0738J
		8/19/2008	17031C0739J
		8/19/2008	17031C0781J
		8/19/2008	17031C0782J
		8/19/2008	17031C0801J
		8/19/2008	17031C0802J
MAYWOOD	170124	8/19/2008	17031C0388J
		8/19/2008	17031C0389J
		8/19/2008	17031C0476J
		8/19/2008	17031C0477J
MCCOOK	170121	8/19/2008	17031C0486J
		8/19/2008	17031C0487J
		8/19/2008	17031C0491J
MELROSE PARK	170125	8/19/2008	17031C0367J
		8/19/2008	17031C0369J
		8/19/2008	17031C0386J
		8/19/2008	17031C0387J
		8/19/2008	17031C0388J
		8/19/2008	17031C0389J
MERRIONETTE PARK	170126	8/19/2008	17031C0637J
MIDLOTHIAN	170127	8/19/2008	17031C0619J
		8/19/2008	17031C0638J
		8/19/2008	17031C0639J
		8/19/2008	17031C0707J
		8/19/2008	17031C0726J
		8/19/2008	17031C0727J
MORTON GROVE	170128	8/19/2008	17031C0237J
		8/19/2008	17031C0241J
		8/19/2008	17031C0242J
		8/19/2008	17031C0243J
		8/19/2008	17031C0244J
MOUNT PROSPECT	170129	8/19/2008	17031C0202J
		8/19/2008	17031C0203J
		8/19/2008	17031C0204J
		8/19/2008	17031C0206J
		8/19/2008	17031C0207J
		8/19/2008	17031C0208J
		8/19/2008	17031C0209J
		8/19/2008	17031C0211J
		8/19/2008	17031C0212J
		8/19/2008	17031C0214J
		8/19/2008	17031C0216J
NILES	170130	8/19/2008	17031C0236J
		8/19/2008	17031C0237J
		8/19/2008	17031C0238J
		8/19/2008	17031C0241J
		8/19/2008	17031C0243J
		8/19/2008	17031C0244J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
NORRIDGE	170131	8/19/2008	17031C0376J
		8/19/2008	17031C0378J
		8/19/2008	17031C0385J
NORTH RIVERSIDE	170135	8/19/2008	17031C0476J
		8/19/2008	17031C0477J
		8/19/2008	17031C0479J
		8/19/2008	17031C0483J
NORTHBROOK	170132	8/19/2008	17031C0069J
		8/19/2008	17031C0088J
		8/19/2008	17031C0089J
		8/19/2008	17031C0093J
		8/19/2008	17031C0207J
		8/19/2008	17031C0226J
		8/19/2008	17031C0227J
		8/19/2008	17031C0231J
		8/19/2008	17031C0232J
NORTHFIELD	170133	8/19/2008	17031C0231J
		8/19/2008	17031C0232J
		8/19/2008	17031C0233J
		8/19/2008	17031C0234J
NORTHLAKE	170134	8/19/2008	17031C0366J
		8/19/2008	17031C0367J
		8/19/2008	17031C0369J
OAK FOREST	170136	8/19/2008	17031C0618J
		8/19/2008	17031C0619J
		8/19/2008	17031C0706J
		8/19/2008	17031C0707J
		8/19/2008	17031C0709J
		8/19/2008	17031C0726J
		8/19/2008	17031C0727J
		8/19/2008	17031C0728J
		8/19/2008	17031C0729J
OAK LAWN	170137	8/19/2008	17031C0606J
		8/19/2008	17031C0607J
		8/19/2008	17031C0608J
		8/19/2008	17031C0609J
		8/19/2008	17031C0617J
		8/19/2008	17031C0628J
OAK PARK	171037	8/19/2008	17031C0395J
		8/19/2008	17031C0485J
OLYMPIA FIELDS	170139	8/19/2008	17031C0739J
		8/19/2008	17031C0743J
ORLAND HILLS	170172	8/19/2008	17031C0701J
		8/19/2008	17031C0702J
		8/19/2008	17031C0703J
		8/19/2008	17031C0704J
ORLAND PARK	170140	8/19/2008	17031C0593J
		8/19/2008	17031C0594J
		8/19/2008	17031C0613J
		8/19/2008	17031C0614J
		8/19/2008	17031C0618J
		8/19/2008	17031C0682J
		8/19/2008	17031C0684J
		8/19/2008	17031C0692J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
ORLAND PARK	170140	8/19/2008	17031C0701J
		8/19/2008	17031C0702J
		8/19/2008	17031C0703J
		8/19/2008	17031C0704J
		8/19/2008	17031C0706J
PALATINE	175170	8/19/2008	17031C0038J
		8/19/2008	17031C0039J
		8/19/2008	17031C0043J
		8/19/2008	17031C0044J
		8/19/2008	17031C0177J
		8/19/2008	17031C0179J
		8/19/2008	17031C0181J
		8/19/2008	17031C0182J
		8/19/2008	17031C0183J
PALOS HEIGHTS	170142	8/19/2008	17031C0612J
		8/19/2008	17031C0614J
		8/19/2008	17031C0616J
		8/19/2008	17031C0617J
		8/19/2008	17031C0618J
		8/19/2008	17031C0619J
PALOS HILLS	170143	8/19/2008	17031C0603J
		8/19/2008	17031C0604J
		8/19/2008	17031C0608J
		8/19/2008	17031C0611J
		8/19/2008	17031C0612J
		8/19/2008	17031C0616J
PALOS PARK	170144	8/19/2008	17031C0591J
		8/19/2008	17031C0592J
		8/19/2008	17031C0594J
		8/19/2008	17031C0611J
		8/19/2008	17031C0612J
		8/19/2008	17031C0613J
		8/19/2008	17031C0614J
		8/19/2008	17031C0616J
PARK FOREST	170145	8/19/2008	17031C0739J
		8/19/2008	17031C0743J
		8/19/2008	17031C0802J
		8/19/2008	17031C0806J
		8/19/2008	17031C0807J
PARK RIDGE	170146	8/19/2008	17031C0236J
		8/19/2008	17031C0237J
		8/19/2008	17031C0238J
		8/19/2008	17031C0376J
PHOENIX	170147	8/19/2008	17031C0732J
		8/19/2008	17031C0751J
POSEN	170148	8/19/2008	17031C0639J
		8/19/2008	17031C0643J
		8/19/2008	17031C0727J
		8/19/2008	17031C0731J
PROSPECT HEIGHTS	170919	8/19/2008	17031C0201J
		8/19/2008	17031C0202J
		8/19/2008	17031C0206J
		8/19/2008	17031C0207J
		8/19/2008	17031C0208J

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
RICHTON PARK	170149	8/19/2008	17031C0781J
		8/19/2008	17031C0782J
		8/19/2008	17031C0801J
		8/19/2008	17031C0802J
RIVER FOREST	170151	8/19/2008	17031C0387J
		8/19/2008	17031C0389J
RIVER GROVE	170152	8/19/2008	17031C0386J
		8/19/2008	17031C0387J
RIVERDALE	170150	8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0645J
		8/19/2008	17031C0661J
		8/19/2008	17031C0663J
RIVERSIDE	170153	8/19/2008	17031C0479J
		8/19/2008	17031C0483J
ROBBINS	170154	8/19/2008	17031C0638J
		8/19/2008	17031C0638J
ROLLING MEADOWS	170155	8/19/2008	17031C0179J
		8/19/2008	17031C0181J
		8/19/2008	17031C0182J
		8/19/2008	17031C0183J
		8/19/2008	17031C0184J
		8/19/2008	17031C0191J
		8/19/2008	17031C0192J
		8/19/2008	17031C0211J
ROSELLE	170216	8/19/2008	17031C0193J
		8/19/2008	17031C0331J
ROSEMONT	170156	8/19/2008	17031C0219J
		8/19/2008	17031C0357J
		8/19/2008	17031C0376J
SAUK VILLAGE	170157	8/19/2008	17031C0764J
		8/19/2008	17031C0768J
		8/19/2008	17031C0826J
		8/19/2008	17031C0827J
		8/19/2008	17031C0831J
SCHAUMBURG	170158	8/19/2008	17031C0167J
		8/19/2008	17031C0169J
		8/19/2008	17031C0179J
		8/19/2008	17031C0183J
		8/19/2008	17031C0184J
		8/19/2008	17031C0186J
		8/19/2008	17031C0187J
		8/19/2008	17031C0188J
		8/19/2008	17031C0189J
		8/19/2008	17031C0191J
		8/19/2008	17031C0192J
		8/19/2008	17031C0193J
		8/19/2008	17031C0194J
		8/19/2008	17031C0307J
SCHILLER PARK	170159	8/19/2008	17031C0357J
		8/19/2008	17031C0359J
		8/19/2008	17031C0376J
		8/19/2008	17031C0378J
SKOKIE	171000	8/19/2008	17031C0234J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
SKOKIE	171000	8/19/2008	17031C0242J
		8/19/2008	17031C0244J
		8/19/2008	17031C0253J
		8/19/2008	17031C0265J
SOUTH BARRINGTON	170161	8/19/2008	17031C0155J
		8/19/2008	17031C0156J
		8/19/2008	17031C0157J
		8/19/2008	17031C0158J
		8/19/2008	17031C0159J
		8/19/2008	17031C0176J
		8/19/2008	17031C0178J
SOUTH CHICAGO HEIGHTS	170162	8/19/2008	17031C0807J
		8/19/2008	17031C0826J
SOUTH HOLLAND	170163	8/19/2008	17031C0732J
		8/19/2008	17031C 0734J
		8/19/2008	17031C0751J
		8/19/2008	17031C0752J
		8/19/2008	17031C0753J
		8/19/2008	17031C0754J
STEGER	170713	8/19/2008	17031C0807J
		8/19/2008	17031C0826J
		8/19/2008	17031C0827J
STICKNEY	170164	8/19/2008	17031C0483J
		8/19/2008	17031C0484J
		8/19/2008	17031C0491J
		8/19/2008	17031C0503J
STONE PARK	170165	8/19/2008	17031C0367J
		8/19/2008	17031C0369J
		8/19/2008	17031C0386J
		8/19/2008	17031C0388J
STREAMWOOD	170166	8/19/2008	17031C0162J
		8/19/2008	17031C0163J
		8/19/2008	17031C0164J
		8/19/2008	17031C0166J
		8/19/2008	17031C0167J
		8/19/2008	17031C0168J
		8/19/2008	17031C0169J
SUMMIT	170167	8/19/2008	17031C0487J
		8/19/2008	17031C0489J
		8/19/2008	17031C0491J
THORNTON	170168	8/19/2008	17031C0734J
		8/19/2008	17031C0742J
		8/19/2008	17031C0753J
		8/19/2008	17031C0761J
TINLEY PARK	170169	8/19/2008	17031C0702J
		8/19/2008	17031C0703J
		8/19/2008	17031C0704J
		8/19/2008	17031C0706J
		8/19/2008	17031C0707J
		8/19/2008	17031C0708J
		8/19/2008	17031C0709J
		8/19/2008	17031C0712J
		8/19/2008	17031C0716J
		8/19/2008	17031C0717J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
TINLEY PARK	170169	8/19/2008	17031C0719J
UNIVERSITY PARK	170708	8/19/2008	17031C0801J
WESTCHESTER	170170	8/19/2008	17031C0456J
		8/19/2008	17031C0457J
		8/19/2008	17031C0458J
		8/19/2008	17031C0459J
		8/19/2008	17031C0476J
WESTERN SPRINGS	170171	8/19/2008	17031C0458J
		8/19/2008	17031C0459J
		8/19/2008	17031C0466J
		8/19/2008	17031C0467J
		8/19/2008	17031C0468J
		8/19/2008	17031C0469J
WHEELING	170173	8/19/2008	17031C0064J
		8/19/2008	17031C0068J
		8/19/2008	17031C0069J
		8/19/2008	17031C0202J
		8/19/2008	17031C0206J
		8/19/2008	17031C0207J
WILLOW SPRINGS	170174	8/19/2008	17031C0469J
		8/19/2008	17031C0488J
		8/19/2008	17031C0581J
		8/19/2008	17031C0582J
		8/19/2008	17031C0584J
		8/19/2008	17031C0601J
WILMETTE	170175	8/19/2008	17031C0234J
		8/19/2008	17031C0253J
		8/19/2008	17031C0255J
		8/19/2008	17031C0260J
WINNETKA	170176	8/19/2008	17031C0113J
		8/19/2008	17031C0232J
		8/19/2008	17031C0251J
		8/19/2008	17031C0253J
		8/19/2008	17031C0255J
WORTH	170177	8/19/2008	17031C0608J
		8/19/2008	17031C0609J
		8/19/2008	17031C0616J
		8/19/2008	17031C0617J
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0020J
		8/19/2008	17031C0038J
		8/19/2008	17031C0039J
		8/19/2008	17031C0043J
		8/19/2008	17031C0044J
		8/19/2008	17031C0063J
		8/19/2008	17031C0064J
		8/19/2008	17031C0068J
		8/19/2008	17031C0069J
		8/19/2008	17031C0088J
		8/19/2008	17031C0089J
		8/19/2008	17031C0094J
		8/19/2008	17031C0113J
		8/19/2008	17031C0142J
		8/19/2008	17031C0144J
		8/19/2008	17031C0155J

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0156J
		8/19/2008	17031C0157J
		8/19/2008	17031C0158J
		8/19/2008	17031C0159J
		8/19/2008	17031C0161J
		8/19/2008	17031C0162J
		8/19/2008	17031C0163J
		8/19/2008	17031C0164J
		8/19/2008	17031C0166J
		8/19/2008	17031C0167J
		8/19/2008	17031C0168J
		8/19/2008	17031C0169J
		8/19/2008	17031C0176J
		8/19/2008	17031C0177J
		8/19/2008	17031C0178J
		8/19/2008	17031C0179J
		8/19/2008	17031C0181J
		8/19/2008	17031C0182J
		8/19/2008	17031C0183J
		8/19/2008	17031C0184J
		8/19/2008	17031C0186J
		8/19/2008	17031C0187J
		8/19/2008	17031C0188J
		8/19/2008	17031C0189J
		8/19/2008	17031C0191J
		8/19/2008	17031C0192J
		8/19/2008	17031C0193J
		8/19/2008	17031C0194J
		8/19/2008	17031C0201J
		8/19/2008	17031C0202J
		8/19/2008	17031C0203J
		8/19/2008	17031C0204J
		8/19/2008	17031C0206J
		8/19/2008	17031C0207J
		8/19/2008	17031C0208J
		8/19/2008	17031C0209J
		8/19/2008	17031C0211J
		8/19/2008	17031C0212J
		8/19/2008	17031C0213J
		8/19/2008	17031C0214J
		8/19/2008	17031C0216J
		8/19/2008	17031C0217J
		8/19/2008	17031C0218J
		8/19/2008	17031C0219J
		8/19/2008	17031C0226J
		8/19/2008	17031C0227J
		8/19/2008	17031C0228J
		8/19/2008	17031C0229J
		8/19/2008	17031C0231J
		8/19/2008	17031C0232J
		8/19/2008	17031C0233J
		8/19/2008	17031C0234J
		8/19/2008	17031C0236J
		8/19/2008	17031C0237J
		8/19/2008	17031C0238J

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0241J
		8/19/2008	17031C0242J
		8/19/2008	17031C0243J
		8/19/2008	17031C0244J
		8/19/2008	17031C0251J
		8/19/2008	17031C0253J
		8/19/2008	17031C0255J
		8/19/2008	17031C0260J
		8/19/2008	17031C0265J
		8/19/2008	17031C0270J
		8/19/2008	17031C0305J
		8/19/2008	17031C0307J
		8/19/2008	17031C0331J
		8/19/2008	17031C0332J
		8/19/2008	17031C0351J
		8/19/2008	17031C0356J
		8/19/2008	17031C0357J
		8/19/2008	17031C0358J
		8/19/2008	17031C0359J
		8/19/2008	17031C0366J
		8/19/2008	17031C0367J
		8/19/2008	17031C0369J
		8/19/2008	17031C0376J
		8/19/2008	17031C0378J
		8/19/2008	17031C0382J
		8/19/2008	17031C0385J
		8/19/2008	17031C0386J
		8/19/2008	17031C0387J
		8/19/2008	17031C0388J
		8/19/2008	17031C0389J
		8/19/2008	17031C0401J
		8/19/2008	17031C0402J
		8/19/2008	17031C0404J
		8/19/2008	17031C0410J
		8/19/2008	17031C0415J
		8/19/2008	17031C0416J
		8/19/2008	17031C0417J
		8/19/2008	17031C0418J
		8/19/2008	17031C0419J
		8/19/2008	17031C0438J
		8/19/2008	17031C0440J
		8/19/2008	17031C0456J
		8/19/2008	17031C0457J
		8/19/2008	17031C0458J
		8/19/2008	17031C0459J
		8/19/2008	17031C0466J
		8/19/2008	17031C0467J
		8/19/2008	17031C0468J
		8/19/2008	17031C0469J
		8/19/2008	17031C0476J
		8/19/2008	17031C0477J
		8/19/2008	17031C0478J
		8/19/2008	17031C0479J
		8/19/2008	17031C0483J
		8/19/2008	17031C0484J

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0486J
		8/19/2008	17031C0487J
		8/19/2008	17031C0488J
		8/19/2008	17031C0489J
		8/19/2008	17031C0491J
		8/19/2008	17031C0492J
		8/19/2008	17031C0503J
		8/19/2008	17031C0504J
		8/19/2008	17031C0506J
		8/19/2008	17031C0507J
		8/19/2008	17031C0508J
		8/19/2008	17031C0526J
		8/19/2008	17031C0528J
		8/19/2008	17031C0529J
		8/19/2008	17031C0540J
		8/19/2008	17031C0545J
		8/19/2008	17031C0567J
		8/19/2008	17031C0569J
		8/19/2008	17031C0579J
		8/19/2008	17031C0581J
		8/19/2008	17031C0582J
		8/19/2008	17031C0583J
		8/19/2008	17031C0584J
		8/19/2008	17031C0586J
		8/19/2008	17031C0587J
		8/19/2008	17031C0588J
		8/19/2008	17031C0589J
		8/19/2008	17031C0591J
		8/19/2008	17031C0592J
		8/19/2008	17031C0593J
		8/19/2008	17031C0594J
		8/19/2008	17031C0601J
		8/19/2008	17031C0602J
		8/19/2008	17031C0603J
		8/19/2008	17031C0604J
		8/19/2008	17031C0606J
		8/19/2008	17031C0607J
		8/19/2008	17031C0608J
		8/19/2008	17031C0609J
		8/19/2008	17031C0611J
		8/19/2008	17031C0612J
		8/19/2008	17031C0613J
		8/19/2008	17031C0614J
		8/19/2008	17031C0616J
		8/19/2008	17031C0617J
		8/19/2008	17031C0618J
		8/19/2008	17031C0619J
		8/19/2008	17031C0628J
		8/19/2008	17031C0636J
		8/19/2008	17031C0637J
		8/19/2008	17031C0638J
		8/19/2008	17031C0639J
		8/19/2008	17031C0643J
		8/19/2008	17031C0644J
		8/19/2008	17031C0645J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0655J
		8/19/2008	17031C0658J
		8/19/2008	17031C0659J
		8/19/2008	17031C0660J
		8/19/2008	17031C0661J
		8/19/2008	17031C0662J
		8/19/2008	17031C0663J
		8/19/2008	17031C0664J
		8/19/2008	17031C0668J
		8/19/2008	17031C0669J
		8/19/2008	17031C0670J
		8/19/2008	17031C0682J
		8/19/2008	17031C0684J
		8/19/2008	17031C0692J
		8/19/2008	17031C0701J
		8/19/2008	17031C0702J
		8/19/2008	17031C0703J
		8/19/2008	17031C0704J
		8/19/2008	17031C0706J
		8/19/2008	17031C0707J
		8/19/2008	17031C0708J
		8/19/2008	17031C0709J
		8/19/2008	17031C0712J
		8/19/2008	17031C0716J
		8/19/2008	17031C0717J
		8/19/2008	17031C0718J
		8/19/2008	17031C0719J
		8/19/2008	17031C0726J
		8/19/2008	17031C0727J
		8/19/2008	17031C0728J
		8/19/2008	17031C0729J
		8/19/2008	17031C0731J
		8/19/2008	17031C0732J
		8/19/2008	17031C0733J
		8/19/2008	17031C0734J
		8/19/2008	17031C0736J
		8/19/2008	17031C0737J
		8/19/2008	17031C0738J
		8/19/2008	17031C0739J
		8/19/2008	17031C0741J
		8/19/2008	17031C0742J
		8/19/2008	17031C0743J
		8/19/2008	17031C0744J
		8/19/2008	17031C0751J
		8/19/2008	17031C0752J
		8/19/2008	17031C0753J
		8/19/2008	17031C0754J
		8/19/2008	17031C0756J
		8/19/2008	17031C0757J
		8/19/2008	17031C0758J
		8/19/2008	17031C0759J
		8/19/2008	17031C0761J
		8/19/2008	17031C0762J
		8/19/2008	17031C0763J
		8/19/2008	17031C0764J

APPENDIX B. COOK COUNTY FIRM PANEL INDEX

COMMUNITY NAME	COMMUNITY NFIP NUMBER	DATE OF EFFECTIVE FIRM	COOK COUNTY FIRM PANEL NUMBERS
UNINCORPORATED COOK COUNTY	170054	8/19/2008	17031C0766J
		8/19/2008	17031C0767J
		8/19/2008	17031C0768J
		8/19/2008	17031C0769J
		8/19/2008	17031C0781J
		8/19/2008	17031C0782J
		8/19/2008	17031C0801J
		8/19/2008	17031C0802J
		8/19/2008	17031C0806J
		8/19/2008	17031C0807J
		8/19/2008	17031C0826J
		8/19/2008	17031C0827J
		8/19/2008	17031C0831J
		8/19/2008	17031C0832J

APPENDIX D

SAMPLE COMPLETED IICP REPORT FORMS

SHORT TERM REQUIREMENTS ANNUAL SUMMARY REPORT
INFILTRATION & INFLOW CONTROL PROGRAM

Reporting Period: January 1st to December 31st, 2015

Satellite Entity: City of Highland Ridge

Latest version of sanitary sewer atlas is dated: November 2013

1. **Condition Assessment Investigation & Rehabilitation of High Risk Sewers:** (reporting year only, unless otherwise noted)

   A. (Complete for first full year of IICP only) To complete the Condition Assessment; is credit requested for prior documented work?

   ☐ No ■ Yes → Submit documentation of previous work and summarize in 1.B.

   B. Public Sector Investigation (attach map showing where investigation was performed):

Inspection Activity	Linear Feet or Number	% of System	% Cumulative[1]
CCTV	91,000	18.2	46.5
Smoke Testing	70,000	14.0	25.0
Dye Testing	3,200	0.6	0.6
Manholes	460	23.0	45.0
Lift Stations	8	100.0	100.0

   C. Public Sector High Priority Deficiencies: (submit a Status of High Priority Deficiencies Form and CIP for those not corrected)

	Main Line	Manhole	Appurtenances	X-Connection
Identified	4	5	0	3
Corrected[2]	3	3	0	1

   D. Private Sector Investigation:

Number of Properties	% of Total System	Internal	External	Int. & Ext.
325	2.5	220	65	40

   E. Private Sector I/I Sources:

	Identified	Corrected	Cumulative Total Remaining
Downspout[3]	2	1	1
Cleanout with Defective/Missing Cover[3]	3	2	1
Area Drain	3	0	3
Storm Sump w/divert valve	2	0	2
Storm Sump to Sanitary	7	3	4
Combination Sump	3	0	3
Unsealed Sanitary Sump	2	0	2
Window Well Drain	5	2	3
Foundation Drain	4	0	4
Lateral	32	0	32
Other:	0	0	0

[1] Include prior years, dating back to first year for which condition assessment credit applies

[2] Submit a Status of High Priority Deficiencies Form and Capital Improvement Plan (CIP) for identified deficiencies not corrected during the reporting year.

[3] Submit a Status of High Priority Deficiencies Form for identified deficiencies not corrected during the reporting year

2. Narrative Description of Progress Made Towards Private Sector Program Development:

Two pilot subdivisions – Meadow Ridge and Willow Glen – have been selected to start a building inspection program to identify illegally connected sump pumps. Approximately 325 properties in these two study areas have been inspected, as noted above. The city has implemented an incentive program to subsidize the cost to homeowners if they voluntarily disconnect their illegal sumps. The city council is currently considering a new sewer use ordinance that would enforce disconnection and provide financial assistance to property owners.

3. Narrative Description of Progress Made Towards Long Term Operation and Maintenance Program Development:

A plan and budgetary costs for citywide CCTV and mainline cleaning cycles has been developed. Acoustic testing has been performed in high priority areas to prioritize cleaning, and pipes subject to heavy sedimentation have been put on a shorter re-inspection cycle. A rate study is underway to determine whether sewer rates will need to be adjusted to pay for remediation of identified public sector sources and subsidies for private sector remediation. The city has also purchased six (6) flow meters and is currently flow monitoring the Meadow Ridge and Willow Glen subdivisions to prioritize future private sector investigations and measure progress toward I/I reduction.

4. Summary of Sanitary Sewer Overflows (SSOs) and Basement Backups (BBs)[1,2]

[1]Include only Reportable Events, which are wet weather SSOs, dry weather SSOs, and BBs caused by public sewer surcharging and blockages under either wet or dry conditions. Do not include BBs caused by collapse/blockage of the private service lateral.
[2]See Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary for definition of "Occurrences" as used in table below.

	# of Occurrences in Dry Weather	# of Occurrences in Wet Weather	# of Occurrences for which cause is known	# of Occurrences outside of High Priority Sewer service areas	# of Occurrences for which cause has been eliminated
SSOs	0	7	7	1	0
BBs	3	85	85	6	2

A. If the causes for any SSOs/BBs for have not been determined, please provide the reason(s): There is one dry-weather BB that is still being investigated by the city and homeowner. It is currently suspected that a temporary blockage in the lateral or mainline sewer caused the backup, but both have been televised and were found to be clear of obstructions.

B. If areas where any SSOs/BBs occurred are served by sewers that have **not** been classified or reclassified as High Priority Sewers, please provide the reason(s): During the May 3 storm event, there was one SSO and 6 reported backups that occurred outside of a previously identified high-priority area due to a power failure at a downstream lift station. A new backup generator has been installed.

C. If there are causes for any SSOs/BBs that have not been eliminated, please provide the reason(s): Remaining SSOs and BBs were caused by excessive I/I. Identification and remediation of I/I sources is underway, and these causes will have been considered eliminated upon completion.

Attachments:

- Condition Assessment Prioritization Form and Map (required with first submittal of this report only)
- Map showing locations of Condition Assessment activities in reporting year (required every year; if credit for pre-IICP condition assessments is sought, map should show locations of pre-IICP assessments)
- Status of High Priority Deficiencies Form (required for years any High Priority Deficiencies have not yet been corrected, and for years immediately succeeding)
- CIP (required for years any public sector High Priority Deficiencies have not yet been corrected)

Certification:

I hereby certify that the information provided in the Annual Report is true and correct

Signature: ______________________ **Date:** February 17, 2016

Printed Name: ______________________ **Title:** ______________________

Telephone: ______________________ **Email:** ______________________

CONDITION ASSESSMENT PRIORITIZATION FORM
INFILTRATION & INFLOW CONTROL PROGRAM

Satellite entities must use this form to explain the criteria used to define which portions of their sanitary sewer system are "high risk". Once the MWRDGC has reviewed and approved a satellite entity's Condition Assessment Prioritization, this form does not need to be resubmitted, unless the satellite entity wishes to modify the criteria it uses to define "high risk" sewers.

Type of Area	Present In System (yes/no)	Prioritization Criteria	Linear Feet of High Priority Sanitary Sewer to be Assessed in Short Term(1)
Areas with SSOs and/or BBs	Yes	High risk areas have had SSOs and/or BBs reported during 1-year rain events and/or dry weather.	50,000
Areas upstream of SSO/BB areas	Yes	Not high risk. All have been lined in last 15 years. All manholes have been inspected and those allowing I/I have been rehabilitated in last 15 years.	0
Sub-basins known to surcharge	Yes	High risk areas have surcharged in 1-year rain event.	50,000(1)
Areas with excessive wet weather flows, other than those listed above	No	Same as areas with SSOs and BBs. No flow metering has been performed to identify other areas with excessive wet weather flows.	0
Areas with excessive lift station pumpage	Yes	Not high risk. Public sewer in area tributary to pump station has been lined over past 10 years. Excessive lift station flows due to private sector I/I.	0
Areas with deficiencies that could result in system failures	Yes	H2S corrosion evident in 15" main along Cambridge Street between First Ave. and Eighth Ave. This is high priority.	4,400
Other (describe)(2)	Yes	Odor complaints submitted every week in dry weather along Gardner Street	2,000

Total length of public sanitary sewers (feet):	500,000
Total length of High Priority sanitary sewer to be assessed in short term (feet):	106,400
Percentage of public sanitary sewer system to be assessed in short term:	21.28%

[1] Include sewers inspected under pre-IICP condition assessment, if applicable.
[2] Attach additional sheets if necessary to describe other types of areas and prioritization criteria

Attachment:

- Map of High Risk Sewers
- Sanitary Sewer System Description and Inventory

Prepared by:

Signature: ______________________ **Date:** February 17, 2016

Printed Name: ______________________ **Title:** ______________________

Telephone: ______________________ **Email:** ______________________

STATUS OF HIGH PRIORITY DEFICIENCIES FORM
INFILTRATION & INFLOW CONTROL PROGRAM

Satellite entities must use this form to track the status of high priority deficiencies that are not corrected during the reporting year in which they are identified. Deficiencies in the public sewer system as well as the private sewer system must be reported on this form. The CIP should correlate to projects listed under "Means of Correction". Satellite entities may attach additional pages, or may generate their own tables showing the status, though any such tables must have the same column headings indicated on this form. If high priority deficiencies identified during pre-IICP condition assessments (if applicable) have not been addressed, include them on this form.

Are additional pages describing deficiencies attached? □ Yes ■ No

ONE YEAR DEFICIENCIES *(direct and indirect cross connections, downspout connections, open or defective cleanout caps)*						
Deficiency ID	**High Priority Deficiency Type**	**Date Identified**	**Anticipated Correction Date**	**Actual Correction Date**(1)	**Means of Correction**	**MWRD Permit Number**(2)
DS_935_ELM	Downspout	7/19/2015	5/1/2016	3/19/2016	Cut and plug w/ concrete cap	n/a
DS_826_MAPLE	Downspout	7/25/2016	5/1/2017	Pending	Cut and plug w/ concrete cap	n/a
CO_325_N_MAIN	Cleanout - missing	7/25/2016	5/1/2017	Pending	New cap	n/a
CO_941_ELM	Cleanout - broken	7/27/2015	5/1/2016	2/16/2016	New cap	n/a
DXC_SANMH_4-36	Direct X-connect.	8/17/2015	5/1/2016	4/19/2016	Plug and connect inlet to storm	NRI 16-6073
IXC_266_S_LINCOLN	Indirect X-connect.	9/16/2015	7/1/2016	8/20/2016	Lined lateral	n/a
IXC_104_S_MAIN	Indirect X-connect.	9/16/2016	6/1/2017	Pending	Point repair on storm sewer	n/a
THREE YEAR DEFICIENCIES *(high priority manhole and mainline defects)*						
Deficiency ID	**High Priority Deficiency Type**	**Date Identified**	**Anticipated Correction Date**	**Actual Correction Date**(1)	**Means of Correction**	**MWRD Permit Number**(2)
MH_9-22	MH – collapsing	8/15/2015	10/30/2016	9/16/2016	Replaced manhole	NRI 16-6275
MH_10-55	MH – missing bricks	8/21/2016	5/30/2017	Pending	Structural liner	n/a
MH_10-86	MH – detached frame	9/3/2015	5/30/2017	Pending	New frame and chimney seal	n/a
3-65:3-64_123FT	Mainline – collapse (PACP5)	10/15/2015	10/30/2016	9/16/2016	Point repair	NRI 16-6276
9-06:9-05_27FT	Mainline – hinge fracture (PACP5)	10/30/2016	5/30/2017	Pending	CIPP liner	n/a

(1) Entries in this column will all be "Not Applicable" in the first Annual Report, but will contain actual completion dates in subsequent reports as repair work is performed.
(2) Enter the permit number once it is issued, if a permit is required for the work.

Prepared by:

Signature: ______________________________ **Date:** February 15, 2017

Printed Name: ______________________________ **Title:** ______________________

Telephone: ______________________________ **Email:** __________________________

SANITARY SEWER OVERFLOW and/or BASEMENT BACKUP
SATELLITE ENTITY INTERNAL SUMMARY

Instructions: Use this form to document all sanitary sewer overflows and/or basement backup discharge occurrences. The following definitions apply:

Sanitary Sewer Overflow: the discharge of untreated sewage from the sanitary sewer collection system to a surface water, storm sewer or ditch, or the ground, due to the circumstances identified below.

Basement Backup: the discharge of untreated sewage into the lower level of a building due to the circumstances identified below.

Use one form per occurrence. A single occurrence may be longer than one day if the circumstance(s) causing the overflow and/or basement backup results in a discharge duration longer than 24 hours. If there is a start and restart of the overflow and/or basement backup within 24 hours and it is caused by the same circumstance(s), report it as a single occurrence. If discharge occurrences are separated by more then 24 hours, they should be reported as separate occurrences. If multiple overflows and/or basement backups occur resulting from the same circumstance, report it as a single occurrence.

The satellite entity must maintain all documentation and/or supporting information pertaining to information provided in this form on record and provide it to the MWRD if/when requested.

Satellite Entity: City of Highland Ridge

Sanitary Sewer Overflow and/or Basement Backup Details:

■ Sanitary Sewer Overflow → ☐ Dry Weather ■ Wet Weather (provide information below)
☐ Basement Backup → ☐ Dry Weather ☐ Wet Weather (provide information below)

Start Date (mm/dd/yy): 05/03/15
Time: 9:45 AM ■ PM ☐
Duration (hours and minutes): 2:15

Estimated Volume (gallons): 1,350
Location (manhole number, address/major intersection, attach spreadsheet for multiple locations): MH 6-34, Lincoln and Main

Pump Used: No ■ Yes ☐ Pump Capacity: n/a GPM

Circumstances Causing the Sanitary Sewer Overflow and/or Basement Backup (check all that apply):

■ Rain	☐ Power Outage	☐ Collapsed Sewer	☐ Lift Station Failure
☐ Snow melt	☐ Equipment failure	☐ Blocked Sewer	☐ Forcemain Break
☐ Widespread Flooding	☐ Fats, Oils, Grease	☐ Roots	☐ Other (explain below)

Explain why the sanitary sewer overflow and/or basement backup occurred. For example, describe what equipment failed, what caused the power outage, or what caused the basement backup. Flooding should only be indicated as a cause if there is significant flooding caused by high river, stream or lake water levels, not just localized high water in the street.

Intense rainfall

Wet Weather Event Information (if applicable):

Start Date: 05/03/15 Time: 8:15 AM ■ PM ☐
End Date: 05/03/15 Time: 3:45 AM ☐ PM ■

Amount of Rainfall (inches): 3.26
Amount of Snow Melt (Inches): 0.00
Contributing Soil Conditions (saturated, frozen, soil type): Damp; 1.5” of rain over previous 3 days

Peak 1-Hour Intensity (inches): 1.93
Rain Gauge Location: Public works garage

Where Did the Discharge from the Overflow and/or Basement Backup Go? (check all that apply)

☐ On the ground and absorbed into the soil

☐ Ditch: Name of surface water it drains into: ______________________________
■ Storm Sewer: Name of surface water it drains into: North Branch of Chicago River
☐ Surface water direct discharge: ______________________________
☐ Basement Backup (number and use, i.e. residential, commercial, of buildings affected): ______________________________
☐ Other (explain): ______________________________

Actions to Correct This Occurrence and Prevent Future Overflows and/or Basement Backups:

1. Describe what actions were taken to minimize the volume of wastewater discharged from the overflow and/or basement backup reported on this form.

The Merrick Lane wet-weather storage facility was pumped down prior to the storm, and the gate valve at the facility remained fully open during the event to maximize utilization of storage volume.

2. Describe if the occurrence reported on this form is part of an area subject to frequent and/or patterns of occurrences and if investigations have been or are planned to be conducted to determine the cause of the frequent and/or patterns of occurrences.

Yes, this manhole is in one of the previously identified high-priority areas and is currently being investigated to locate sources of I/I. Smoke testing and dye tracing in this area is planned for summer 2015.

3. Describe what corrective actions are planned to prevent or minimize future sanitary sewer overflows and/or basement backups.

Money has been budgeted to rehabilitate manholes and mainline sewers in this area in 2016 and 2017. Following the I/I source investigations, notifications will be sent to private property owners to encourage the disconnection of private sector sources.

Final Determination for the Cause of the Overflow(s) and/or Basement Backup(s): (check one)

☐ Private Property Sewer → Explain: ______________________________

■ Municipal Sewer → Explain: During the peak of the rain event, flow exceeded the mainline sewer capacity, causing it to surcharge and overflow.

Report Completed By:

Name: ______________
Title: ______________
Street Address: ______________
City: ______________ ZIP: ______________
Phone: ______________
Email: ______________

Authorized Satellite Entity Representative:

Name: ______________
Title: ______________
Street Address: ______________
City: ______________ ZIP: ______________
Phone: ______________
Email: ______________

____
Authorized Satellite Entity Signature

May 6, 2015
Date

Rev. 1/15

SANITARY SEWER SYSTEM DESCRIPTION AND INVENTORY
INFILTRATION & INFLOW CONTROL PROGRAM

Submit this form upon completion of condition assessment and after completing any substantial sewer system improvement.

Date: 10/27/15

Reason for Submitting:
■ Completion of condition assessment
☐ Substantial sewer system improvement. Describe improvement: ____________

___

A. Sanitary Sewer System Description

1. Is part of the Agency's service area Combined? (check one)
   ■ No
   ☐ Yes, _______% Combined

2. Separate Sanitary Sewer Service Area: 6,200 acres

3. Separate Sanitary Sewer Service Area Population Equivalent (PE[1]) Served:
   Residential: 46,000 Non-Residential: 2,700 Total: 48,700

4. Description of Municipal Sewer System Ownership: (check one)
   ☐ Main line sewers only
   ■ Main line sewer and service lateral connection only
   ☐ Main line sewer and service lateral to the ROW, easement, property line, or cleanout
   ☐ Main line sewer and entire service lateral to the building
   ☐ Other: ____________________

B. Sanitary Sewer System Inventory (separate sewer area only)

A. Sanitary Sewer System Inventory:

Gravity Sewer (ft)	Manholes	Force main (ft)	Lift Stations	Siphons	Connections to MWRD
500,000	2,000	22,700	8	0	3

B. Age Distribution of the Collection System:

Age	Gravity (ft)	Force main (ft)	Lift Station
0 – 25 years	125,000	7,200	5
26 – 50 years	235,000	10,500	3
>51	140,000	5,000	0
Total	500,000	22,700	8

C. Size Distribution of the Collection System:

Diameter	Gravity (ft)	Force main (ft)
≤8 inches	335,000	16,800
9 – 18 inches	87,000	5,900
19 – 36 inches	35,000	0
>36 inches	43,000	0
Total	500,000	22,700

D. Distribution of Collection System by Material:

Material	Gravity (ft)	Force main (ft)
PVC	110,000	
RCP	62,000	
CP (Concrete Pipe)		
VCP (Vitrified Clay Pipe)	328,000	
CCCP (Prestressed Concrete Cylinder)		
Steel		
DIP		12,000
CIP		8,300
HDPE		2,400
FRP (Fiberglass Reinforced Plastic)		
RPMP (Techite)		
ACP (Asbestos Cement Pipe)		
Other:		
Other:		

E. Number of Service Connections:

Residential	Commercial	Industrial	Other	Total
18,750	83	3	4	18,840

[1]PE = 100 gal/person/day

Long Term Operation & Maintenance Program Annual Summary Report
Infiltration & Inflow Control Program

Do not leave any blank spaces on this form, except where indicated. Use "X" for checking applicable information. Submit any supporting documentation when/where required. Submit a Sanitary Sewer System Description and Inventory Form upon completion of condition assessment and for any substantial sewer system improvement.

Reporting Period: January 1st to December 31st, 2021

Latest version of the sanitary sewer atlas is dated: November 2019 **Format:** □ **Paper** ■ **GIS** □ **CAD**

Satellite Entity Information: (to be completed by Public Works Director, or similar)

Satellite Entity: City of Highland Ridge
Address: ______ **City:** ______ **Zip:** ______

Representative: ______ **Title:** Director of Public Works
Telephone: ______ **Fax:** ______ **Email:** ______

Certification:
I hereby certify that the information provided in the Annual Report is true and correct.

Signature: ______ **Date:** ______

I. Event Reporting

A. Basement Backups (BBs): (reportable events only)

	BBs for Current Year	BBs for Previous Year
Number of Occurrences	12	27

1. Were BBs addressed by installing overhead sewers (OHS), backflow prevention devices (BPD), local storage facilities (LSF), or other measures? (indicate number addressed)
   - □ No
   - ■ Yes # of OHS: 8 #of BPD: 2 # of LSF: 0
   - □ Other Explain: ______

2. Describe reason(s) if cause(s) could not be identified and/or addressed:

   Several homes in the vicinity of the Brainerd Road Lift Station backed up during the April 13 storm. Phase I engineering for upgrades to the lift station and/or local storage are currently underway.

3. Describe how many of the BBs reported above are recurring (i.e. more than one occurrence during the reporting year) and action taken for investigation and their elimination:

   Number of recurring events: 1
   Action taken: Overhead sewer connection was installed with assistance of city subsidy.

B. Sanitary Sewer Overflows (SSOs):

1. SSO Reporting:

	Dry Weather for Current Year	Dry Weather for Previous Year	Wet Weather for Current Year	Wet Weather for Previous Year
Main Line	0	1	4	9
Lift Station	0	0	2	3

2. Describe how many of the SSOs were identified and/or eliminated or if the cause could not be identified and/or eliminated:

   All SSOs occurred due to wet-weather flows in excess of system capacity. Capacity and storage options in these locations are currently under review.

3. Describe how many of the SSOs reported above are recurring (i.e. more than one occurrence during the reporting year) and action taken for investigation and their elimination:

   Number of recurring events: 3
   Action taken: Feasibility analysis for wet-weather pumping to local storage

II. Sanitary Sewer System Inspection & Maintenance:

A. Inspection of Sanitary Sewer System

	Main Line (Ft)	Force main (Ft)	% of Total	Manholes (Nos)	% of Total
CCTV	65,000		13.0		
Smoke Testing	30,000		6.0	120	6.0
Dye Testing	10,000		2.0	36	1.8
Visual[1]				250	12.5
Acoustic Emissions Testing		1,450	6.5		
Pole Camera Inspection				2	0.1
Other:					

(1) Visual inspection of manholes includes surface inspections and full descent inspections of manholes. Such inspections shall be performed in accordance with NASSCO standards.

B. Lift Station Inspection

	Inspected and Serviced (Nos)	% of Total in System
Lift Stations	8	100.0

C. Maintenance of Sanitary Sewer System

	Sewer (ft)			Appurtenances (Nos)	
	Main Line	Force Main	% of Total	Manholes	% of Total
Cleaning	8,200	0	1.6	35	1.7
Root Cutting	6,400	0	1.3	25	1.3
Chemical Root Control	21,000	0	4.2	82	4.1
FOG treatment	40,000	2,300	8.4	153	7.6
Other:					
Other:					

D. High Priority Deficiencies: (submit a status of High Priority Deficiencies Form and CIP for deficiencies identified but not corrected during the reporting year)

Type	Identified (length or number)	Corrected (length or number)
Main Line	5	2
Manholes	1	1
Lift Stations	0	0

E. Estimated Annual Expenditure

Budget for Reporting Year: $650,000

Expenditures for Reporting Year: $587,000

III. Sanitary Sewer System Rehabilitation

A. Public Sector Rehabilitation:

1. Main Line Sewer:

	Length or Number	% of System
Replacement	260	0.1
CIPP Lining	11,000	2.2
Point Repairs	1	
Grouting	0	
Cross-Connections	3	
Other:		

2. Manholes:

Complete Rehabilitation	Partial Rehabilitation	Replacement	Grouting
3	23	2	37

3. Lift Stations:

Number	Type of Rehabilitation
1	Replaced comminutor; rehabbed dry well

B. Private Sector Rehabilitation:

1. I/I Sources Identified: (submit a list of property addresses for those not corrected and a schedule for correcting them)

	Number of Properties Identified	Removed/Corrected
Downspout	2	2
Area Drains/Driveway Drains	1	0
Open Cleanout	7	7
Storm Sump to Sanitary	11	2
Storm Sump w/divert valve	9	4
Combination Sump	5	0
Unsealed Sanitary Sump	2	0
Window Well Drains	16	13
Foundation Drains	3	0
Lateral	57	3

IV. Sanitary Sewer System Flow Monitoring

Was flow monitoring of the sanitary sewer conducted during the reporting year?

□ No (skip remaining questions in Section IV)
■ Yes (provide information requested below)

A. Flow Monitoring Equipment:

Number of Flow Meters: 3
Start Date of Flow Monitoring: 3/4/2021 End Date of Flow Monitoring: 9/7/2021

Were rain gauges used? □ No ■ Yes
If used, provide rain gauge location(s): public works garage

B. Flow Monitoring Service Area & Results:

1. Service Area Information & Results:

Service Area Number	Service Area Size (acres)	Service Area PE[1]	Average Dry Weather Flow (gpcpd)	Peak Wet Weather Flow (gpcpd)	Peak Wet : Average Dry Weather Raito
1	135	731	82	910	11.1
2	220	1,377	113	1,035	9.2
3	76	525	76	289	3.8

[1]PE = 100 gal/person/day

2. For service areas with Peak Wet : Average Dry Weather ratios above 4:1, describe how areas will be prioritized for I/I investigation and removal/rehabilitation:

Manhole inspections and smoke testing in Service Areas 1 and 2 with follow-up dye testing has been budgeted for the coming year.

APPENDIX D

NASSCO CODES SUMMARY

NASSCO'S PIPELINE ASSESSMENT & CERTIFICATION PROGRAM (PACP)©

Section 4—Continuous Defect Coding

"TRULY" 4-1

"Truly" continuous defects run along the sewer without any interruption for more than three feet (1 meter).
Examples:
- Longitudinal Fractures
- Longitudinal Cracks

"REPEATED" 4-1

"Repeated" continuous defects occur at regular intervals along the sewer. These occur at pipe joints and include:
-Encrustation
-Open Joints
-Circumferential Fractures

Code Changes in Version 6.0.1

Added:
Buckling Wall (KW), Buckling Dimpling (KD), and **Buckling Inverse Curvature (KI)**

Section 5—Structural Defect Coding (Module 6A)

C CRACK 5-1
CL Longitudinal 5-2
CC Circumferential 5-2
CM Multiple 5-2
CS Spiral 5-2
CH Hinge 5-2

F FRACTURE 5-7
FL Longitudinal 5-7
FC Circumferential 5-7
FM Multiple 5-7
FS Spiral 5-7
FH Hinge 5-7

B BROKEN 5-15
BSV -Soil Visible Beyond Defect 5-15
BV V -Void Visible Beyond Defect 5-15

H HOLE 5-17
HSV -Soil Visible Beyond Defect 5-17
HV V -Void Visible Beyond Defect 5-17

D DEFORMED 5-19
DV Deformed Vertically (brick) 5-19
DH Deformed Horizontally (brick) 5-19

X COLLAPSE 5-23
XP Pipe Collapse 5-23
XB Brick Collapse 5-23

J JOINT 5-26
JO Joint Offset (Displaced) 5-26
JS Joint Separated (Open) 5-26
JA Joint Angular 5-26

S SURFACE DAMAGE 5-31
SRI Roughness Increased 5-31
SRI - M - Mechanical
SRI - C - Chemical
SRI - Z - Not Evident

S SURFACE DAMAGE 5-31
SAV Aggregate Visible 5-31
SAV - M - Mechanical
SAV - C - Chemical
SAV - Z - Not Evident

S SURFACE DAMAGE 5-31
SAP Aggregate Projecting 5-31
SAP - M - Mechanical
SAP - C - Chemical
SAP - Z - Not Evident

S SURFACE DAMAGE 5-31
SAM Aggregate Missing 5-31
SAM - M - Mechanical
SAM - C - Chemical Attack
SAM - Z - Not Evident

S SURFACE DAMAGE 5-31
SRV Reinforcement Visible 5-31
SRV - M - Mechanical
SRV - C - Chemical Attack
SRV - Z - Not Evident

S SURFACE DAMAGE 5-31
SRP Reinforcement Projecting 5-31
SRP - M - Mechanical
SRP - C - Chemical Attack
SRP - Z - Not Evident

S SURFACE DAMAGE 5-31
SRC Reinforcement Corroded 5-31
SRC - M - Mechanical
SRC - C - Chemical Attack
SRC - Z - Not Evident

S SURFACE DAMAGE 5-31
SMW Missing Wall 5-32
SMW - M - Mechanical
SMW - C - Chemical Attack
SMW - Z - Not Evident

S SURFACE DAMAGE 5-31
SSS Surface Spalling 5-32
SSS - M - Mechanical
SSS - C - Chemical Attack
SSS - Z - Not Evident

S SURFACE DAMAGE 5-31
SZ Other 5-32
SZ - M - Mechanical
SZ - C - Chemical Attack
SZ - Z - Not Evident

S SURFACE DAMAGE 5-31
SCP Corrosion (metal pipe) 5-32
*no modifiers used

K BUCKLING 5-45
KW Wall 5-45
KD Dimpling 5-45
KI Inverse Curvature 5-45

LF LINING FAILURE 5-49
LFD Detached Lining 5-49
LFDE Defective End 5-49
LFB Blistered Lining 5-49
LFCS Service Cut Shifted 5-49
LFAC Abandoned Connection 5-49

LF LINING FAILURE 5-49
(continued)
LFOC Overcut Service 5-49
LFUC Undercut Service 5-49
LFBK Buckled Lining 5-49
LFW Wrinkled Lining 5-49
LFAS Annular Space 5-49

LF LINING FAILURE 5-50
LFBU Bulges 5-50
LFDC Discoloration 5-50
LFDL Delamination 5-50
LFRS Resin Slug 5-50
LFPH Pinholes 5-50
LFZ Other 5-50

WF WELD FAILURE 5-67
WFL Longitudinal 5-67
WFC Circumferential 5-67
WFM Multiple 5-67
WFS Spiral 5-67
WFZ Unidentified 5-67

RP POINT REPAIR 5-71
RPR Pipe Replaced 5-69
RPR - D -Defective 5-69
RPP Patch Repair 5-69
RPP - D -Defective 5-69

RP POINT REPAIR 5-71
RPL Localized Pipeliner 5–69
RPL - D -Defective 5-69
RPZ Other 5-69
RPZ - D -Defective 5-69

BRICKWORK 5-77
DB Displaced 5-75
MB Missing 5-75
DI Dropped Invert 5-75

BRICKWORK 5-77
MM Missing Mortar 5-75
S -Small 5-75
M -Medium 5-75
L -Large 5-75

Updated November 2010

NASSCO'S PIPELINE ASSESSMENT & CERTIFICATION PROGRAM (PACP)©

Section 6—Operational and Maintenance (Module 6B)

D	DEPOSITS	6-1
DA	Attached	6-1
DAE	-Encrustation	6-2
DAGS	-Grease	6-2
DAR	-Ragging	6-2
DAZ	-Other	6-2

D	DEPOSITS	6-1
DS	Settled	6-1
DSF	-Fine	6-2
DSGV	-Gravel	6-2
DSC	-Hard/Compacted	6-2
DSZ	-Other	6-2

D	DEPOSITS (continued)	6-1
DN	Ingress	6-1
DNF	-Fine (silt & sand)	6-3
DNGV	-Gravel	6-3
DNZ	-Other	6-3

R	ROOTS	6-7
RF	Fine	6-7
RFB	-Barrel	6-7
RFL	-Lateral	6-7
RFC	-Connection	6-8

R	ROOTS	6-7
RT	Tap	6-7
RTB	-Barrel	6-7
RTL	-Lateral	6-7
RTC	-Connection	6-8

R	ROOTS	6-7
RM	Medium	6-7
RMB	-Barrel	6-7
RML	-Lateral	6-7
RMC	-Connection	6-8

R	ROOTS	6-7
RB	Ball	6-7
RBB	-Barrel	6-7
RBL	-Lateral	6-7
RBC	-Connection	6-8

I	INFILTRATION	6-13
IS	Stain	6-13
IW	Weeper	6-13
ID	Dripper	6-13
IR	Runner	6-13
IG	Gusher	6-13

OB	OBSTACLES/ OBSTRUCTIONS	6-19
OBB	Brick or Masonry	6-19
OBM	Pipe Material in Invert	6-19
OBI	Object protruding through wall	6-19

OB	OBSTACLES/ OBSTRUCTIONS	6-19
OBJ	Object wedged in joint	6-19
OBC	Object through connection/junction	6-19
OBP	External Pipe Cable	6-19

OB	OBSTACLES/ OBSTRUCTIONS	6-19
OBS	Built into structure	6-20
OBN	Construction Debris	6-20
OBR	Rocks	6-20
OBZ	Other	6-20

V	VERMIN	6-31
VR	Rat	6-31
VC	Cockroach	6-31
VZ	Other	6-31

G	GROUT TEST & SEAL	6-33
GTP	Grout Test Passed	6-33
GTP - J - Joint		6-33
GTP - L - Lateral		6-33
GTF	Grout Test Failed	6-33

G	GROUT TEST & SEAL	6-33
GTU	Grout Test Unable	6-33
GTU - J - Joint		6-33
GTU - L - Lateral		6-33
GRT	Grout Test Location	6-33

Section 7—Construction Features Coding (Module 6C)

T	TAP	7-1
TF	Factory Made	7-1
TFI	-Intruding	7-2
TFA	-Active	7-2
TFC	-Capped	7-2
TFB	-Abandoned	7-2
TFD	-Defective	7-2

T	TAP	7-1
TB	Break In/Hammer	7-2
TBI	-Intruding	7-2
TBA	-Active	7-2
TBC	-Capped	7-2
TBB	-Abandoned	7-2
TBD	-Defective	7-2

T	TAP	7-1
TS	Saddle	7-2
TSI	-Intruding	7-2
TSA	-Active	7-2
TSC	-Capped	7-2
TSB	-Abandoned	7-2
TSD	-Defective	7-2

T	TAP	7-1
TR	Rehabilitated	7-2
TRI	-Intruding	7-2
TRA	-Active	7-2
TRC	-Capped	7-2
TRB	-Abandoned	7-2
TRD	-Defective	7-2

IS	INTRUDING SEALING MATERIAL	7-9
ISSR	Sealing Ring	7-9
ISSRH	-Hanging	7-9
ISSRB	-Broken	7-9
ISSRL	-Loose	7-9

IS	INTRUDING SEALING MATERIAL	7-9
ISGT	Grout	7-9
ISZ	Other	7-9

L	LINE (of sewer)	7-11
LL	Left	7-11
LLU	Left Up	7-11
LLD	Left Down	7-11
LR	Right	7-11

L	LINE (of sewer)	7-11
LRU	Right Up	7-11
LRD	Right Down	7-11
LU	Up	7-11
LD	Down	7-11

A	ACCESS POINT	7-13
AMH	Manhole	7-13
AWA	Wastewater Access	7-13
ADP	Discharge Point	7-13
ATC	Tee Connection	7-13

A	ACCESS POINT	7-13
AOC	Other Special Chamber	7-13
AM	Meter	7-13
AWW	Wet Well	7-14
AJB	Junction Box	7-14

A	ACCESS POINT	7-13
ACO	Clean Out	7-14
ACOM	-Mainline	7-14
ACOP	-Property	7-14
ACOH	-House	7-14

A	ACCESS POINT	7-13
ACB	Catch Basin	7-14
AEP	End of Pipe	7-14

Section 8—Miscellaneous Features Coding (Module 6D)

M	MISCELLANEOUS FEATURES	8-1
MCU	Camera Underwater	8-1
MGO	General Observation	8-1
MGP	General Photograph	8-1
MSC	Shape/Size Change (Sewer Dimension/Vertical/ Horizontal)	8-1
MJL	Joint Length Change	8-1

M	MISCELLANEOUS FEATURES	8-1
MLC	Lining Change	8-2
MMC	Material Change	8-2
MSA	Survey Abandoned	8-2
MWL	Water Level	8-2
MWLS	-Sag	8-2

M	MISCELLANEOUS FEATURES	8-1
MWM	Water Mark	8-2
MY	Dye Test	8-2
MYV	-Dye Visible	8-3
MYN	-Not Visible	8-3

Updated November 2010

APPENDIX D

SAMPLE CAPITAL IMPROVEMENT PLAN (CIP)

APPENDIX D: SAMPLE EXCERPT FROM CAPITAL IMPROVEMENT PLAN (CIP)

Satellite Entity: Village of Sunnybrook

Date of Revision to CIP: January 9, 2016

Capital Improvement Projects:

Project Number:	2016012	Planned Fiscal Year:	FY2016	Project Name:	FY2016 Sewer Cleaning/CIPP lining
Project Scope Description:	Sanitary sewer cleaning and lining of problem areas identified through CCTV			Project Area Description (1):	Surf Street between Park Ave. and 2nd Ave.; Prospect Blvd between Main Street and Gardner Street; Fuller Street between Blackstone Pkwy and Ottawa Ave.
Cost:	$800,000			Funding Source:	Water/sewer General fund
Estimated Start Date:	4/4/2016	Estimated Duration:	180 days	Estimated Completion Date:	10/1/2016
Project Ranking:				1	

(1) An exhibit showing project location may be attached.

Project Number:	2017023	Planned Fiscal Year:	FY2017	Project Name:	Wagner Road Sewer and Water Main Replacement
Project Scope Description:	Replace deteriorated section of 6” water main with Class II ductile iron pipe; replace service to b. boxes; replace 8” and 10” concrete sanitary sewer with same size SDR 26 PVC; replace lateral connections and laterals to property line.			Project Area Description:	Wagner Road between Division Street and Fairview Road
Cost:	$1,200,000			Funding Source:	SRF loan
Estimated Start Date:	1/18/2017	Estimated Duration:	270 days	Estimated Completion Date:	10/15/2017
Project Ranking:				2	

<table>
<tr><td>Project Number:</td><td>2017025</td><td>Planned Fiscal Year:</td><td>FY2017</td><td>Project Name:</td><td colspan="2">FY2017 Sewer Cleaning/CIPP lining</td></tr>
<tr><td>Project Scope Description:</td><td colspan="3">Sanitary sewer cleaning and lining of problem areas identified through CCTV</td><td>Project Area Description:</td><td colspan="2">See attachment for areas</td></tr>
<tr><td>Cost:</td><td colspan="3">$810,000</td><td>Funding Source:</td><td colspan="2">Water/sewer General fund</td></tr>
<tr><td>Estimated Start Date:</td><td>4/4/2017</td><td colspan="2">Estimated Duration:</td><td>180 days</td><td>Estimated Completion Date:</td><td>10/1/2017</td></tr>
<tr><td colspan="4">Project Ranking:</td><td colspan="3">3</td></tr>
</table>

<table>
<tr><td>Project Number:</td><td>2016064</td><td>Planned Fiscal Year:</td><td>FY2016</td><td>Project Name:</td><td colspan="2">Smith Avenue Road Repair</td></tr>
<tr><td>Project Scope Description:</td><td colspan="3">Full depth pavement replacement; new curb and gutter; add stormwater inlets; replace deteriorated manholes and catch basins</td><td>Project Area Description:</td><td colspan="2">Smith Avenue between First Avenue and Eighth Avenue</td></tr>
<tr><td>Cost:</td><td colspan="3">$150,000 (manholes only)</td><td>Funding Source:</td><td colspan="2">Water/sewer General fund (manholes only)</td></tr>
<tr><td>Estimated Start Date:</td><td>4/18/2016</td><td colspan="2">Estimated Duration:</td><td>180 days</td><td>Estimated Completion Date:</td><td>10/15/2016</td></tr>
<tr><td colspan="4">Project Ranking:</td><td colspan="3">4</td></tr>
</table>

<table>
<tr><td>Project Number:</td><td>2016075</td><td>Planned Fiscal Year:</td><td>FY2016</td><td>Project Name:</td><td colspan="2">Manhole Repairs, Various Locations</td></tr>
<tr><td>Project Scope Description:</td><td colspan="3">Manhole replacement, frame/lid replacement, frame/lid adjustment, manhole lining, chimney seal addition where required</td><td>Project Area Description:</td><td colspan="2">See attachment for areas</td></tr>
<tr><td>Cost:</td><td colspan="3">$450,000</td><td>Funding Source:</td><td colspan="2">Water/sewer General fund</td></tr>
<tr><td>Estimated Start Date:</td><td>5/15/2016</td><td colspan="2">Estimated Duration:</td><td>120 days</td><td>Estimated Completion Date:</td><td>9/12/2016</td></tr>
<tr><td colspan="4">Project Ranking:</td><td colspan="3">5</td></tr>
</table>

APPENDIX D

SAMPLE PRIVATE SECTOR PROGRAM (PSP)

APPENDIX D: SAMPLE PRIVATE SECTOR PROGRAM

Satellite Entity: Village of Sunnybrook

In recognition of the fact that a large portion of excessive wet weather flow in sanitary sewer systems comes from the privately-owned sector of the sanitary sewer system, the Village of Sunnybrook has developed a Private Sector Program (PSP). This PSP is intended to prohibit new illegal clear water connections to the sanitary sewer system, compel property owners with illegal clear water connections or sources of excessive infiltration to eliminate them, establish a public information program to enhance awareness of the risks posed by illegal clear water connections, and establish a long term program under which illegal connections that are costly to correct may be removed over time.

The components of the Village of Sunnybrook PSP are described below:

1. Staffing

The PSP will be overseen by the Director of Public Works. Three Water/Sewer Technicians will be trained in how to conduct internal and external private property inspections for sources of infiltration and inflow. These technicians will receive training on how I/I sources can be identified using smoke testing and dyed water testing. The technicians will receive training on how to document findings from private property inspections. Smoke testing and dyed water testing of multiple private properties for I/I studies will be outsourced to consultants. The Director of Public Works has the authority to determine when a private property should be inspected. On average, the Director of Public Works will spend eight hours per month on the PSP, while each of the technicians will spend sixteen hours per month each on the PSP.

2. Local Authority

The Village has adopted the following ordinances (copies attached) allowing inspections of private property for illegal clear water connections to the sanitary sewer system:

- 15-007 authorizes inspections when the Village has determined that the property is located in an area subject to sanitary sewer overflows (SSOs) and basement backups (BBs), or that the property is in an area that contributes to sanitary sewer overflows and basement backups in another area
- 15-121 authorizes inspections in conjunction with complaints related to water service, sewers, flooding, and utilities
- 15-130 requires inspection and repair or replacement, if necessary, of service laterals in conjunction with tear-downs and substantial improvement of structures

3. Inspection Program

If more than three wet weather SSOs or BBs occur in a subbasin within a calendar year (either during the same event or different events), and if these events are not attributed to blockages of private laterals at the locations where the events took place (eg., laterals clogged by roots, crushed laterals, etc.), the Village shall investigate the cause of the SSOs or BBs. The investigation may include televising of the public sewer, inspection of lift station(s) (if present), and inspection of private properties in the subbasin and in the subbasin immediately upstream. The Village will inspect private properties if the cause of the SSOs/BBs seems to be private sector I/I, and the public sewer system appears to not be a significant contributor of I/I. Depending the age of the system, severity of the problem and other site-specific factors, the Village may decide to inspect the private sewer laterals as well.

The Village will inspect all properties for illegal connections to the sanitary sewer system when Public Works staff needs to enter a home to address complaints related to flooding, sewers, water service, or utilities.

A sample inspection checklist is attached.

A private property is determined to be non-compliant if it has any of the following:

- A directly connected downspout
- A poorly-disconnected downspout that allows substantial leakage of stormwater into the sanitary sewer
- A cleanout or sanitary manhole missing a cover
- A cleanout or sanitary manhole with a cover that allows water inside
- A stormwater sump pump that discharges to the sanitary sewer

If a private property has none of the above defects, but has any of the following, it shall be considered partially-compliant:

- A foundation drain that discharges directly or indirectly to the sanitary sewer
- An area drain
- Window well drains
- Driveway drains
- A sanitary sump that also serves as a sump for groundwater, when no other sump for groundwater is present
- A leaky sewer lateral

The Village's goal is to inspect all properties with basements once every 20 years through any of the aforementioned scenarios.

4. Non-Compliance Correction

When a property is found to be non-compliant, the inspectors will verbally inform the property owner, and show them the non-compliant conditions. A letter will be sent to the property owner within two weeks of the inspection describing the non-compliant conditions and requiring correction of the non-complaint conditions within 90 days. The Village will post on its website a list of licensed, bonded contractors who are capable of performing the corrective work.

Property owners are required to notify the Public Works Department when the non-compliant conditions are corrected. The Village will send inspectors to the private property within seven working days to inspect the correction.

When properties are found to be in partial compliance, the Village inspectors will show the property owners the illegal connection. The Village will send a letter and report to the property owner documenting the illegal condition. The letter will encourage the property owner to correct the condition and will provide information about the Village’s cost-sharing programs for lateral rehabilitation, sump repair and installation, rain garden construction, and storm sewer extension. The letter will also inform the property owner that in the event of substantial improvement to the property, the illegal conditions must be corrected. Similarly, in the event of a teardown, the lateral must be replaced or lined.

5. Long Term Program to Address High Cost I/I Sources

The Village will maintain records of each property that is found to have high-cost I/I sources during inspections. This list will include all properties found to have high-cost I/I sources during the first five years of the IICP. The type of the I/I source or sources (footing drain, area drain, driveway drain, window well drain, sump pits collecting groundwater that discharge to the sanitary sewer, leaky lateral) will be recorded with the date of the inspection. The Village has cost sharing programs set up for lateral rehabilitation, sump repair and installation, rain garden construction, and storm sewer extension. Property owners may apply to participate in any of these programs to implement improvements to redirect groundwater and stormwater out of the sanitary sewer system. Depending upon availability of funds and severity of SSOs and BBs, the Village may increase funding of its cost-sharing programs and/or directly fund some private property improvements.

The Village's ordinances requiring correction of illegal I/I sources in conjunction with substantial improvements to properties will result in removal of such sources over time. Similarly, the Village's ordinance requiring replacement or lining of laterals in conjunction with tear downs will also reduce I/I in the system over time. When some or all of a property's high-cost I/I sources are corrected, the Village will update the list to include the dates of the correction work.

The list of properties with high-cost I/I sources will be provided to the Community Development Department. Updated versions will be provided quarterly. It will be responsibility of the Community Development Department to consult the list of properties with high-cost I/I sources any time a property transfer stamp is issued. If a property transfer stamp is issued to a property on the list, the Community Development Department will mail a letter to the new property owner within 30 days of the issuance of the transfer stamp. The letter will notify the owner of the presence of high-cost I/I sources and will provide information about the long term program to address high cost I/I sources.

6. Enforcement

If the non-compliant conditions are not addressed within 90 days, other than when a violation notice is issued after September 1, in which case the non-compliant condition must be addressed in 120 days, a violation notice will be issued to the property owner which requires the condition to be corrected in 14 days and requires payment of a penalty. The violation notice will state that water service may be shut off in the event of continued non-compliance. If the conditions are not addressed within 14 days, a second violation notice will be issued and water service will be shut off. The Village may elect to initiate a suit against non-compliant property owners.

When a non-compliant property submits a building permit application for substantial improvement, the submitted drawings must include disconnection of all illegal I/I sources. A building permit will not be issued unless the drawings include this work. If/when the Village begins a program of directly funding some private property improvements, enforcement measures for non-compliance will be determined at that time.

7. Funding

The Village will fund its PSP through Water/Sewer fees. Should grant or loan funding become available from regional, state or federal agencies, the Village will investigate those potential sources to supplement the PSP.

8. Public Information

The Village will develop brochures and post information on its website about on the following topics:

- Sources of Clear Water from Private Property, why property owners should be concerned, and actions they can take to correct the problems
- The Village's cost sharing program for lateral rehabilitation
- The Village's cost sharing program for sump repair and installation
- The Village's cost-sharing program for rain garden construction
- The Village's cost-sharing program for storm sewer extension

These brochures will be included with letters sent to property owners in areas experiencing SSOs and BBs, as well as letters notifying property owners that they have illegal connections to the sanitary sewer. The Village will include a brief article on the topic of private sector I/I in each issue of its quarterly newsletter. The brochures will be handed out at public meetings as appropriate.

APPENDIX D

SAMPLE PRIVATE PROPERTY INSPECTION CHECKLIST

PRIVATE PROPERTY INSPECTION CHECKLIST

Inspection #: ______________________ **Inspection Date:** ______________________

Address: ______________________ **Inspected By:** ______________________

GENERAL

1. Property Type: ☐ Single Family ☐ Multi Family ☐ Commercial ☐ Other
2. Sanitary Plumbing Type: ☐ Gravity ☐ Overhead
3. Foundation Type: ☐ Basement ☐ Crawl Space ☐ Slab
4. Has the property experienced a sewer backup? ☐ No ☐ Yes
5. Has the property experienced stormwater flooding? ☐ No ☐ Yes

EXTERNAL

6. Are there underground downspouts with no visible discharge location? ☐ No ☐ Yes
7. Does the property have outside drains? ☐ No ☐ Yes
   7a. If outside drains exist, record the number of each type: Area ___ Driveway ___ Patio ___ Stairwell ___ Window Well ___

INTERNAL

8. Basement Dimensions: __________ x __________
9. Basement Grade: ______________________

EJECTOR PUMP

10. Does the property have an ejector pump? ☐ No ☐ Yes
11. Is the ejector pit sealed? ☐ No ☐ Yes
12. Where does the ejector pump discharge? ☐ To Ground ☐ To Sanitary ☐ Unknown
13. Cover Type: ______________________________________
14. Check Valve: ☐ No ☐ Yes

CLEARWATER SUMP

15. Does the property have a clearwater sump? ☐ No ☐ Yes
16. Where does the clearwater sump discharge? ☐ Storm Sewer ☐ Sanitary Sewer ☐ Over Ground ☐ Unknown
17. Are there any visible sanitary utilities entering the clearwater sump, i.e. is it a combination sump? ☐ No ☐ Yes
18. Identify the type of drains entering the sump pit: ☐ Floor Drain ☐ Footing Drain ☐ Laundry Drain ☐ Bathroom ☐ Shower
19. Is the bottom of the sump pit sealed? ☐ No ☐ Yes
20. Cover type: ☐ Bolted ☐ Loose ☐ None ☐ Other ______________
21. Check Valve: ☐ No ☐ Yes

INSIDE PIPING AND FLOOR DRAINS

22. Is there a direct connection between sanitary and clearwater piping? ☐ No ☐ Yes
23. Are there observable diverters? ☐ No ☐ Yes
24. Are there floor drains? ☐ No ☐ Yes
25. Is there a suspected footing tile connection? ☐ No ☐ Yes

DYE TEST

26. Were dye tests performed? ☐ No ☐ Yes

26a. List dye tests performed:

______________________ Positive? ☐ No ☐ Yes

______________________ Positive? ☐ No ☐ Yes

______________________ Positive? ☐ No ☐ Yes

COMMENTS: ____

____

____

____

NOTIFICATION CHECKLIST

Letter: ______
1st Pass: ______
2nd Pass: ______
Final Notice: ______

APPENDIX D

TEMPLATE LONG TERM O&M PROGRAM (LTOMP)

Satellite Entity: Village of Sunnybrook

The Village of Sunnybrook's sanitary sewer system is designed to remove wastewater from homes and other buildings and convey it to the intercepting sewer system owned and operated by the Metropolitan Water Reclamation District of Greater Chicago (MWRD), which conveys flow to wastewater treatment plants. A sanitary sewer system that is not properly maintained, operated and repaired can pose risks to the environment and to public health. These risks arise from system failures or when excessive infiltration and inflow (I/I) enters the sanitary sewer system. I/I reduces the capacity of the sanitary sewer system and can result in sanitary sewer overflows (SSOs) and basement backups (BBs), which are illegal. This long term operation and maintenance program (LTOMP) will be continually implemented by the Village of Sunnybrook to maintain sewer system capacity and performance, thereby reducing SSOs and BBs.

The goals of this LTOMP are to:

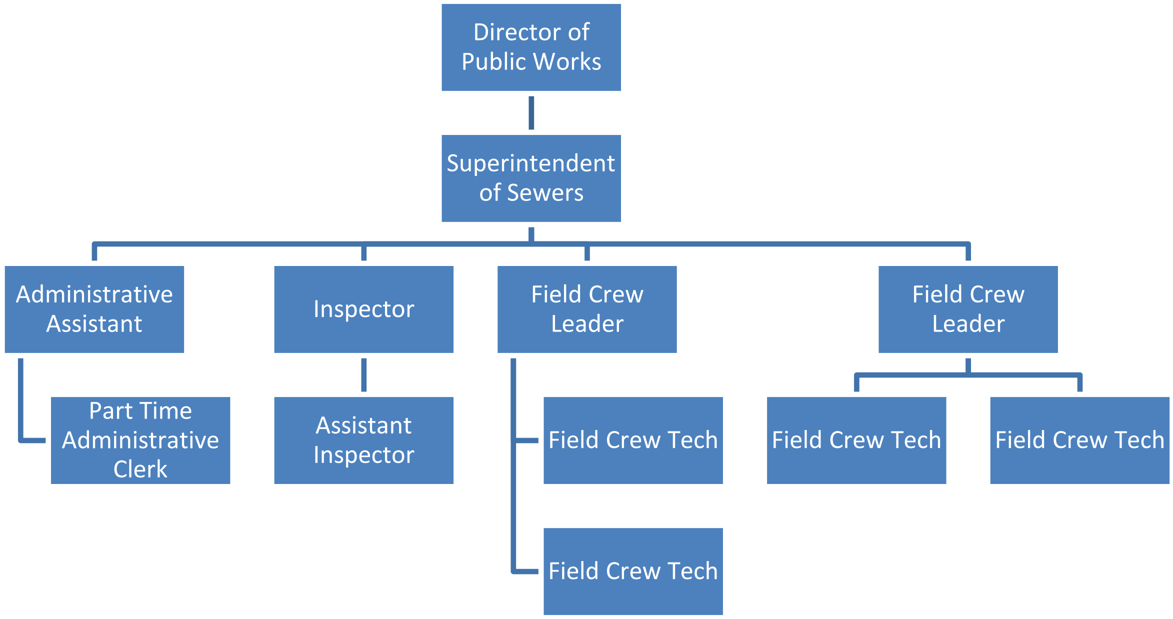
- Establish standards and procedures by which the Village of Sunnybrook will maintain, operate, repair, and expand its sanitary sewer system
- Establish responsibility for the Village to maintain and operate the sanitary sewer system
- Maximize uptime of the entire sanitary sewer system while conducting maintenance, operation, repair and replacement work as economically as possible
- Reduce SSOs and BB

I. Sewer System Management

A. Staffing

The Village of Sunnybrook's Sewer Division is under the Department of Public Works and is responsible for cleaning, inspecting, and maintaining all of the sanitary sewers owned by the Village. This includes providing information of the Director of Public Works about the need for rehabilitation and replacement of portions of the sanitary sewer system. This information is conveyed to the Village Engineer, who is responsible for design and construction of sewer rehabilitation projects and inspection of new connections to the sanitary sewer system. The Sewer Division provides data to the Village GIS Coordinator to have information tracked in the Village's GIS updated accurately. The Sewer Division is responsible for implementation of the Private Sector Program for reducing I/I. The Sewer Division has a staff of ten full time and one part time operation and maintenance positions. Contractors are used for some maintenance activities, rehabilitation and replacement, televising of sewers, and for emergency support. Figure 1 shows the organizational structure of the Sewer Division.

Figure 1- Village of Sunnybrook Sewer Division Organizational Chart



Director of Public Works – Establishes policy, plans strategy, leads staff and delegates responsibility, allocates resources, authorizes outside contractors to perform services, and may serve as public information officer.

Village Engineer – Prepares wastewater collection system planning and design documents, manages capital improvement delivery system, documents new and rehabilitated assets, and coordinates development and implementation of CMOM Plan. The Village Engineer is required to have a Professional Engineer's License.

Superintendent of Sewers – Manages field operations and maintenance activities, provides relevant information to agency management, prepares and implements contingency plans, leads emergency response, investigates and reports SSOs, and trains field crews.

Inspector – Ensures that new and rehabilitated assets meet Village standards, works with field crews to handle emergencies when contractors are involved, and provides reports to Village Engineer and Superintendent of Sewers. Assists Superintendent with investigations of complaints.

Assistant Inspector - Helps Inspector with duties.

Field Crew – Conducts staff operations and preventive maintenance activities, mobilize and respond to notification of stoppages and SSOs (e.g., mobilize sewer cleaning equipment, by-pass pumping equipment, and portable generators).

Administrative Assistant – Support staff operations and preventive maintenance activities, assist with data entry and quality control, handle billing, dispatch, routing of phone calls, maintains inventory list, maintains log of training for Sewer Division staff, and other support functions as needed.

Part Time Administrative Clerk - Responsible for filing, archiving of drawings, records, and reports, processing payroll, and other tasks to help the Administrative Assistant.

B. Safety

Work in and around sewers introduces a wide range of safety hazards. Training on safe practices associated with sewer inspection, construction, and maintenance is an essential part of minimizing accidents on the job. The Superintendent of Sewers conducts safety training for staff on a monthly basis, and may hold additional training sessions as needed depending on the nature of work and staff familiarity with safety hazards. The Administrative Assistant maintains the log of training session attended by staff. Refresher training on safety topics is required on an annual basis for all staff. Topics for which training is given include:

1. Confined Space Entry procedures
2. Traffic control and hazards
3. CPR and First Aid
4. Lock out/tag out
5. Use of portable gas detectors
6. Hazardous environments
7. Use of SCBA
8. Slips, trips, falls
9. Safe lifting techniques
10. Biohazards
11. Chemical handling
12. Electrical and mechanical equipment safe practices
13. Pneumatic and hydraulic system safe practices
14. Excavation and trenching

Hard hats, safety shoes, gloves, eye protection, and vests are worn at all times by staff working in the field. The Sewer Division makes safety equipment available to staff for use, including tyvek suits, face shields, tripod, harness, cable, ladders, waterproof boots/waders, flashlights, SCBA, respirators, 5 minute escape packs, portable gas detectors, and blowers.

C. Training

Keeping staff informed on current trends and practices on sewer inspection, construction and maintenance is necessary to ensure the Village is maintaining the sanitary sewer system in a manner that optimizes resources. Training is provided on the following topics:

1. Trenchless technology
2. Sewer rehabilitation methods
3. Sewer inspection methods
4. Customer service
5. SSO/BB emergency response

D. Internal Communication

Routine matters are communicated verbally or via email. All Sewer Division staff except for the Part Time Administrative Clerk and Administrative Assistant have smart phones and two-way radios. Procedures and policies are communicated via memo. In emergency situations, immediate communication is handled by smart phones or radios.

E. Customer Service and Complaint Procedure

The Administrative Assistant receives complaints made via phone and by email sent to the general email address (sewerdivision@sunnybrook.il.us.org). The Administrative Assistant fills out a complaint form, shown in Figure 2, assigns a unique number to the complaint, and immediately forwards the form to the Superintendent of Sewers. Depending on the nature/severity of the problem, the Superintendent will either conduct an investigation or will delegate this task to the Inspector. Investigations typically involve a site visit, review of Village drawings and documents on the issue, and dispatching the field crew to rectify the problem, if the problem falls within the jurisdiction of the Village. Complaints are assigned a unique number based on the order in which they are received. The Superintendent maintains a log of complaints that includes the name of the person filing the complaint, date and time when the complaint was made, location of the problem, a brief description of the problem, the name of the employee assigned to handle the complaint and the date of resolution. A report of the investigation and actions taken to address the matter, or an explanation of why the problem is beyond the Village's jurisdiction, is prepared and kept on file. A record in the Village's GIS is created for this complaint. The Village's goal is to follow up with parties making complaints within two full business days of receiving the complaint.

The Village publishes and updates brochures on the following topics:

- Basic information about sanitary sewer systems for homeowners, including what to do if a sewer is overflowing or a basement is backing up
- Proper disposal of fats, oils and greases for homeowners
- The Village's cost sharing programs for I/I removal

As part of its commitment to customer service, the Village holds a Public Works Open House every April to give residents an opportunity to learn about the work of this department.

Residents are notified via Village newsletter and door hangers before any capital improvements to sewers take place on their block.

Brochures and public information notices are included in utility bill mailings from time to time. For example, every February a reminder to notify the Village about observed SSOs and BBs is included with the water bill.

Figure 2 - Complaint Form

COMPLAINT NUMBER: ____________

DATE:_____________________ TIME: ______________________ COMPLAINT RECEIVED BY:__________

COMPLAINT REPORTED BY:____

ADDRESS:____

TELEPHONE NUMBER: ____

EMAIL ADDRESS:____

COMPLAINT LOCATION:____

DETAILS OF COMPLAINT:____

CHECK APPROPRIATE BOXES:

SEWER SYSTEM COMPLAINTS

- ☐ MANHOLE COVER MISSING
- ☐ MANHOLE COVER LOOSE OR NOISY
- ☐ ODORS-GASES
- ☐ MANHOLE CAVE-IN
- ☐ SEWER LINE CAVE-IN
- ☐ MANHOLE SURCHARGING
- ☐ STREET FLOODED
- ☐ YARD FLOODED
- ☐ BUILDING FLOODED[1]
- ☐ OTHER

[1]Building flooding includes flooding of basement, crawl space or first floor

LIFT STATION COMPLAINTS

- ☐ ODORS
- ☐ FLOODING
- ☐ STOPPAGES
- ☐ UNKEPT GROUNDS
- ☐ SPILLS
- ☐ OTHER

____

ACTION TAKEN:

- ☐ INITIATE INVESTIGATION BY ___________________; INVESTIGATOR ASSIGNED:___________
  (DATE) (STAFF NAME)
- ☐ ASSIGN TO OTHER DEPARTMENT:___________________ ON _________________________
  (DEPARTMENT NAME) (DATE)
- ☐ OWNER TO REPAIR
- ☐ HEALTH DEPARTMENT NOTIFIED
- ☐ WATER DEPARTMENT NOTIFIED

ACTION TAKEN BY: ____ DATE:_____________________

F. Management Information Systems

The Village uses a computerized maintenance management system, {insert system name here}, to manage information on our collection system. This system is connected to the Village's Geographic Information System (GIS), which is described below. System information managed in the CMMS includes:

General

- Parts inventory
- Equipment and tools
- Purchase orders
- Revenue
- Safety incidents

Collection System

- Collection system mapping
- Collection system inventory
- FOG compliance
- SSO/Emergency response
- Industrial discharge monitoring results

Maintenance program

- Routine and Priority Planned maintenance (cleaning, etc.)
- Inspection scheduling and tracking
  - Manhole
  - Pipeline (Closed Circuit Television (CCTV), camera)
  - Pump station
  - Force mains
- Work Orders
- Vehicle maintenance
- Equipment maintenance
- Service contract information

Repair, Rehabiltation, and Replacement program

- Locations of repairs
- Start/end stations of rehabilitation or replacement
- Method of repair/rehabilitation
- Date repair/rehabilitation/replacement was completed
- Contract number under which repair/rehabilitation/replacement was performed

Customer service program

- Complaints/BB reports
- Customer service response
- Billing information

Any activity performed by department personnel is generated and tracked through the CMMS. The CMMS produces weekly written work orders for the performance of routine maintenance as well as repairs and corrective actions in response to inspection findings or customer complaints. Upon completion of the task(s), data related to the work order is entered into the CMMS for tracking performance and historical information on manholes, lift stations, gravity sewer lines, laterals, and force mains. The serves as the Village's information management system for the all of the collection systems operation and maintenance.

The CMMS is operated through the Village's Local Area Network (LAN). The system is backed up every night and access is restricted. All staff in the Department of Sewers have a user name and password that allows them access to use the CMMS, however, privileges are limited to the scope of each employee's position.

G. Sewer Mapping / GIS

Like many departments in the Village of Sunnybrook, the Sewer Division enters and tracks data in the Village's GIS. The Village receives support from Cook County for providing updated information on parcels, PINs, and aerial photography. The following information that is relevant to our collection system is included in our GIS:

Manholes Map Information

- Unique ID number
- GPS coordinates
- Invert elevation(s)
- Rim elevation
- Date built
- GPS coordinates
- Diameter
- Method of rehabilitation and date (if applicable)

Sewer Lines Map Information

- Unique ID number
- Location
- Diameter
- Direction of flow
- Length between manholes
- Material type
- Date built
- Slope
- Service lateral locations (where known)
- Method of rehabilitation and date (if applicable)

Pump Station Map Information

- ID number
- Location
- Capacity
- Date built

Force Main Map Information

- ID number
- Location
- Direction of flow and pump station associated
- Length
- Material type
- Location of air release valves
- Date built
- Capacity
- Slope
- Invert elevations

General Map Information

- Parcel boundaries
- Building footprints
- Overflow points
- MWRD interceptors serving the Village of Sunnybrook
- Boundaries of separate sewer areas tributary to MWRD connections
- Floodplains
- Rivers and creeks
- Roads
- Municipal boundaries
- Complaints
- Reported SSOs and BBs

The Village's GIS is maintained by the Village GIS Coordinator. If new information pertaining to sewers is to be added to the GIS, the Superintendent of Sewers submits a GIS work request to the GIS Coordinator describing the scope of the change. The GIS Coordinator works with the Superintendent to enter the revised data into GIS. Once the Superintendent approves a draft version of the change, the updated information is published on the Village GIS. Changes due to new repair information and new rehabilitation work are to be submitted to the GIS Coordinator within three business days of the completion of the repair or rehabilitation work. Changes to correct information due to findings made in the field are to be submitted to the GIS Coordinator within one business day. Location of lateral information is added to the GIS as this information is discovered during routine CCTV inspections. Location of lateral information is submitted to the GIS Coordinator on a weekly basis, when such information has been found.

New employees attend a 2-hour training session on use of the Village's GIS with the GIS Coordinator. Additional training on how to use the Village's GIS is provided to all Department of Sewers staff as needed, when new functions are added to the GIS or when a major upgrade to the system is made, changing the way staff use the system.

H. SSO/BB Tracking and Notification

One of the goals of this LTOMP is to reduce SSOs and BBs. The Sewer Division is dedicated to maintaining and operating the sanitary sewer system to minimize public health risks and environmental degradation attributed to sewage overflows. One essential part of achieving this goal is to know where, when and why SSOs and BBs occur.

Many reports of SSOs and all reports of BBs will be received from calls from members of the general public. Such calls are routed to the Sewer Division Administrative Assistant during normal business hours and after hours are routed to the Village system dispatcher. The person receiving the call fills out the complaint form shown in Figure 2 based upon information provided by the caller. The form is sent to the Superintendent of Sewers immediately upon conclusion of the call.

If an overflow occurs at a lift station, this is detected by the wet well level detector. The lift station telemetry system automatically sends a text message to the Superintendent's cellular phone when the depth of water in the wet well is 2' below the rim elevation of the manhole upstream of the lift station. Upon receiving such text messages, the Superintendent will investigate the site or direct the inspector to do so.

The Superintendent is responsible for responding to the complaints and for managing the response to SSOs and BBs, and making key decisions. His responsibility is to assess the situation and initiate a series of response actions based on the type and severity of the event.

The Superintendent of Sewers will confirm the overflow and implement measures to stop the overflow as noted in the procedures in the next section. Within 5 days of confirming that an SSO or BB has occurred, the Superintendent will complete the MWRD's Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary form. Copies of this form are placed in the complaint file and the SSO/BB file. A copy of this form will also be provided to the Village GIS Coordinator so that the repair can be added to the GIS. The MWRD may request to view these files or perform an audit on the Village's records, therefore, this file is maintained permanently.

If the overflow results in a fish kill, the Sewer Division will notify IEPA and the MWRD by phone within two hours of becoming aware of the results of the fish kill.

The Superintendent of Sewers reviews the file of Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary forms at least annually to monitor patterns in occurrences of SSOs/BBs and to determine where further inspection, operational changes, revisions to sewer cleaning schedules and/or rehabilitation are needed.

If more than three wet weather SSOs or BBs occur in a sanitary sewer sub-basin within a calendar year (either during the same event or different events), and if these events are not attributed to blockages of private laterals at the locations where the events took place (eg., laterals clogged by roots, crushed laterals, etc.), the Village will investigate the cause of the SSOs or BBs. The investigation may include televising of the public sewer, inspection of lift station(s) (if present), and inspection of private properties in the sub-basin and in the sub-basin immediately upstream. The Village will inspect private properties if the cause of the SSOs/BBs seems to be private sector I/I, and the public sewer system appears to not be a significant contributor of I/I. Depending the age of the system, severity of the problem and other site-specific factors, the Village may decide to inspect the private sewer laterals as well.

I. SSO Response

Once the Superintendent has confirmed that an SSO has occurred, he dispatches a Field Crew to contain the overflow and determine the cause. Contact with the Field Crew during normal working hours is made via radio. Contact during off hours is made via cellular phone.

The Field Crew follows in-house procedures for addressing sewer blockages or backups into a basement and overflowing manholes resulting from a surcharged public sewer. For a basement backup, the Field Crew determines whether the cause of the backup is a problem with the private lateral or with the public sewer. This is done by inspecting the quantity of flow in public manholes upstream and downstream of the lateral for the house experiencing the backup. If the public manhole is the cause of the problem, then the Field Crew initiates procedures to pump around the blockage. In the case of a surcharging manhole, the Field Crew initiates procedures to pump around the blockage, clean and disinfect the ground surface, and clear the obstruction. This may require emergency services for televising and/or rodding the line.

In all cases, response crews report their findings, including possible damage to private and public property, to the Superintendent immediately upon making their investigation. If the Superintendent has not received findings from the field crew within one (1) hour, the Superintendent contacts the response crew to determine the status of the investigation. After the SSO/BB is addressed and all required reporting has been completed, information on the location, date, duration and magnitude of the SSO/BB is provided to the GIS Coordinator for inclusion in the Village GIS.

If hazardous substances are suspected in the overflow, personnel are to contact the Fire Department via 911 immediately.

J. Emergency Preparedness and Response

To achieve the goal of maximizing sanitary sewer system uptime for the residents of the Village of Sunnybrook, the Department of Public Works and the Sewer Division have developed emergency procedures. The previous section addresses routine emergencies of SSOs and BBs. The Village has established in-house procedures for handling larger, though routine, emergencies including sewer main breaks, force main breaks, air release and vacuum release valve failures, and pump station failures. In all cases, a Field Crew is dispatched to the area to assess the situation. Two crews may need to be dispatched in the case of a sewer main break so that one crew addresses the break itself and another performs troubleshooting at the lift station. Depending on the nature of the emergency and whether all Field Crews are occupied, the Superintendent may call upon outside contractors to assist with sewer televising, cleaning, and site cleanup. The Village maintains contracts for these services at all times. The contracts are advertised every two years.

Anytime sanitary sewage is released to the ground surface or inside of occupied space of a building, an MWRD Sanitary Sewer Overflow and/or Basement Backup Satellite Entity Internal Summary form is completed. The form is signed by the Superintendent. Copies of this form are placed in the repairs file and the SSO/BB file. A copy of this form is also provided to the Village GIS Coordinator so that the repair can be added to the GIS.

The Village's Emergency Management Department has developed a written Catastrophic Emergency Management Plan, which is attached. This plan was developed in conjunction with the Department of Public Works and the Sewer Division. Most elements of the plan are undertaken by the Emergency Management Department or the Fire Department. For example, for emergencies involving multiple departments, the Emergency Management Department determines when emergency procedures should begin and end. This is conveyed to the Department Heads, who then convey this information to staff. The Emergency Management Plan addresses road closures, flooding, tornados, confined space rescue operations, and power outages. The plan incorporates the following:

- Although both lift stations have a natural gas generator as a backup source of power, the Village has a mobile generator that can be connected to either pump station as a source of backup power.
- Sewer Division staff have two-way radios as well as cellular phones for communication, in case one system does not work.
- The Sewer Division owns several pumps and can rent additional pumps from a local equipment supplier on short notice if necessary to pump sewage around an obstruction or to supplement pumps at a lift station that are not working as required
- During certain emergencies (such as floods) additional staff are needed on a temporary basis to respond to calls from the public and to handle operational problems in the sewer system. Typically, part time and off duty staff are required to work mandatory overtime to cover these needs. Contractors may be hired on a temporary basis as well to cover these needs, although this is not the preferred option.

The Superintendent prepares a report following each emergency describing the cause of the emergency, how the Sewer Division responded, number and nature of calls received from the public, whether/how outside service contractors were used, what was handled well, what should be handled differently in the future, and an estimate of the amount of money spent on the emergency. This report is kept in the Emergencies file. Information from the report may be used to revise this document and other written procedures, determine the scope of capital improvement projects, justify staffing level adjustments, and modify training programs.

K. FOG program

Fats, oils, and greases (FOG) that enter the sanitary sewer system in significant quantities will usually solidify downstream from the point of discharge into the sewer and form deposits on interior surfaces of the sewer. FOG can be a major factor in reducing sewer capacity which leads to SSOs in dry weather as well as wet weather. Food service establishments (FSE) and large apartment buildings are the largest generators of FOG. Due to the presence of both in the Village of Sunnybrook, the Department of Public Works and the Health Department administer a FOG control program.

The Sewer Use Ordinance grants the Village the authority to administer a FOG program. Permits from the Village are required when a restaurant begins operation in the Village. Similarly, if a property owner modifies a sanitary sewer or constructs a building to be used as an FSE, a permit from the Village and from the MWRD is required. In all cases, FSEs must demonstrate that a grease interceptor or a grease basin will be installed to intercept flow from food preparation areas. Sanitary waste from other parts of the building, particularly restrooms, must not be routed to the grease interceptor or basins. IN addition, wastewater discharged from dishwashing machines must bypass grease interceptors and basins otherwise the hot water would liquefy the collected FOG and convey it into the sanitary sewer system where it would solidify and obstruct flow.

FSEs are required to have their grease basins and interceptors serviced at least every 90 days. The Village of Sunnybrook Health Department conducts annual inspections of FSEs, as well as random inspections, to observe FOG handling practices, review the grease interceptor/basin maintenance log, and look for signs of improper FOG disposal. Citations are issued to FSEs that violate the requirements of the FOG program.

Public information is another component of the FOG program. The Village publishes a FOG fact sheet with recommended best practices for FSEs. This is available on the Village website and the Health Department inspectors also give it to FSEs during their inspections. A brochure for residents is available at the Public Works Building and during the annual Public Works Open House. The brochure explains the reasons homeowners need to be concerned about FOG in the sanitary sewer system and recommends best practices for minimizing FOG disposal down the drain.

II. Equipment and Collection System Maintenance

The Village of Sunnybrook recognizes the importance of regular maintenance activities to minimize emergencies and costly repairs. The CMMS generates a report each week detailing preventive maintenance activities that are required for portions of the collection system and for lift station equipment. The report is based upon:

- Manufacturer's recommendations in equipment operation and maintenance manuals
- Records of portions of the sanitary sewer system where frequent (annual basis, or more frequent) maintenance work is required
- Age of sewers
- Criticality of facilities in area served by a sewer

The Superintendent reviews the weekly report and divides the tasks among the field crews, indicating which tasks have higher priority. In general, the higher priority tasks should be performed first. Each field crew leader is responsible for verifying that the sewer maintenance truck has the necessary equipment to complete the tasks before leaving the Public Works Yard each day. Each field crew leader submits a daily report of the crew's activities along with any relevant inspection or activity checklists completed during the day to the Superintendent.

The attached map identifies portions of the sanitary sewer system that require

- Cleaning on an annual basis
- Cleaning every 10 years
- Root control every 3 years
- Inspection via CCTV every 3 years (sewer main)
- Inspection via CCTV every 10 years (sewer main)
- Inspection via full descent every 3 years (manholes)
- Inspection via full descent every 10 years (manholes)
- Surface inspection every 3 years (manholes)
- Surface inspection every 10 years (manholes)

If complaints are received and the Superintendent determines that maintenance work is required to address a problem, the Superintendent will add the required tasks to the daily assignments for a field crew.

If an emergency occurs during the working day and the Superintendent determines that a field crew is required to assist with resolving the emergency, he will contact the field crew leader most likely to reach the site of the emergency most quickly. The field crew will conclude their maintenance tasks, document the extent of their work on the daily report, then will mobilize to the site of the emergency.

Field crew members and leaders alternate being on-call for off-hours emergencies. If an emergency occurs off-hours and the Superintendent determines that a field crew is needed to help resolve the emergency, the Superintendent will call the field crew leader on his cellular phone. The field crew leader will call his field technicians on his cellular phone.

The Superintendent forwards daily maintenance reports, emergency reports, and maintenance checklists to the Inspector to enter information into the CMMS.

A. Sewer Cleaning

The Village owns two vacuum/sewer cleaning (vactor) trucks, one of which is available for use by each Field Crew. The vactor trucks are capable of high-pressure jetting of sewers (up to 600 psi). The Village also owns power rodding machines that are capable of removing obstructions from municipal sewers. The Village has a biannual contracts for the following:

1. Septage hauling services, which is utilized when sewage and debris quantities exceeding the capacity of the Village vactor trucks are generated by a task
2. High pressure hydro-jetting services is used to clear obstructions in sewers when the Village's own equipment is unable to do so
3. Root control service using foam containing diquat dibromide

The root control service is used in areas where root growth has been a historical problem and where new areas of significant root growth are observed during CCTV inspection.

In general, routine sewer cleaning work is performed within one week preceding routine CCTV inspections. Most of the public sewer system is cleaned on a 10 year cycle however, certain areas with known issues (low velocity, high sedimentation, and FOG deposition) are cleaned on an annual basis. The quantity of debris is closely monitored when these segments of the sewer system are cleaned. Adjustments are made on a continual basis to the list of sewer reaches requiring frequent cleaning in order to optimize resources and clean only portions of the system that require it.

B. Lift Stations and Force Mains

The Village of Sunnybrook has two sanitary lift stations in its system, the George Street lift station and the Lake Avenue lift station. Both lift stations have mechanical and electrical equipment housed in a pump house. Both lift stations have backup natural gas generators as a secondary source of power. A telemetry system using cellular signal transmission allows for monitoring of the status of pumps, flow meters, wet well elevations, backup generators, and station entry alarms from the Public Works Building. The pump control system is programmed to generate text messages which are sent to the cellular phone of the Superintendent when high wet well elevation, pump motor failure, and station entry alarms are tripped. The Superintendent or his designee will visit the pump station to address any of these alarms. A record of such incidences and the actions taken to resolve them is entered into the CMMS.

Field crews perform cleaning and routine maintenance checks of the pump stations on a bi-weekly basis. During these visits, the field crews check on the pump station structures, lighting fixtures, unit heaters, and sweep the station. Any maintenance activities required in the operation and maintenance manuals for the pumps, motors, backup generators, telemetry equipment and force main magmeters are performed during these visits. Copies of the pump station equipment operation and maintenance manuals are stored at the Public Works Building. The pump operation and maintenance manuals include pump manufacturer's name, model number, size, capacity, spare parts list, schematic drawings of the piping system, wiring schematics, design float switch elevations, narrative description of operation, and contact information for the vendor's local representative for service. The Village CMMS produces reminders of required routine maintenance based upon the manufacturers' recommendations and these activities are listed in the weekly reports generated by the CMMS that form the basis of the field crews' assignments.

The Village of Sunnybrook currently has two force mains in the collection system with a combined length of 2.3 miles. The George Street force main has four air release valves located at the high points and the Lake Avenue force main has five air release valves. The Sewer Division inspects and maintains the air release valves semi-annually by back flushing the valves with clean water using a minimum of 30 psi. All air release valves and valve vaults are inspected for signs of corrosion, connection point leakage, or improper operating characteristics.

The pressure on the discharge side of the pumps at the lift stations is used to determine the need for force main cleaning. If the backpressure is more than 25% greater than the expected total operating head, the discharge pipe will be cleaned. Pressure gauges at lift stations are calibrated annually.

A record of all routine maintenance visits is entered into the CMMS each day a field crew visits a lift station. The record includes: star and end time of visit, personnel performing inspections, checks performed, observations, discharge flow rate and pressure observed during visit, weather conditions during visit, maintenance work performed, and spare parts used.

III. Material and Equipment

The Sewer Division provides operations and maintenance crews with the essential work related items they use on a day-to-day routine basis. Should new or replacement equipment or tools be needed, the crew leader notifies the Inspector. The Inspector will issue the crew leader stocked items. For non-stocked items, the Inspector advises the crew leader of a local vendor and requests a purchase order for the needed item(s). The crew leader will then procure the requested items through the local vendor in an "in-stock" format.

The Village of Sunnybrook keeps a limited supply of spare equipment and tools for personnel. In lieu of maintaining a full supply of spare equipment and tools for personnel, the Village has an annual "supply bid" for essential common equipment and tools. This bid requires the vendor to maintain "in-stock" items listed in the annual bid, and the vendor must have a local storefront for item pick-up. Non-bid equipment and tools can be purchased in amounts up to two thousand dollars ($2000.00).

The large equipment and tools needed for certain tasks such as sewer cleaning and inspection are purchased through the Purchasing Department for permanent acquisition of the item for the Village.

The Inspector is responsible for ensuring accurate inventories of material and equipment used by the Division is maintained. This involves adding new material and equipment to the inventories, deleting equipment that the Division no longer owns, updating quantities as material is used. The inventories are reviewed two times per year by the Inspector. The inventories are maintained in an Excel spreadsheet. Information tracked for equipment includes type, age, description/use, manufacturer, fuel type (where applicable), year of acquisition, estimated year for replacement, operating costs, and repair history. The estimated remaining life of the equipment inventory is calculated based on the date of manufacture, an estimate by the Sewer Division of the useful life expected, and factors that might be expected to extend or reduce the life of the equipment (e.g., repairs or hard use).

IV. Sewer System Capacity Evaluation

As a fully developed community, the Village of Sunnybrook does not anticipate the need to extend the sanitary sewer system by any significant amount for the foreseeable future. In general, the existing sanitary sewer system is sized to accommodate dry weather flow from the tributary areas as developed. However, the following circumstances could trigger the need to evaluate the capacity of the existing sanitary sewer system and determine if an increase in conveyance capacity is justified:

- An area experiences dry weather SSOs and/or BBs that cannot be attributed to maintenance issues or deteriorated sewers.
- An area is being redeveloped and the projected dry weather flow exceeds that of the current land use.

Should either of these situations occur, the Village Engineer will consider the current and proposed population within the service area, capacity of the existing sewer(s) serving the areas, elevations of existing sewers and of existing laterals. The capacity of the sanitary sewer system should conform to the standards established in the MWRD's Watershed Management Ordinance (WMO) in effect at the time. Typically, sanitary sewers are to be sized for the anticipated population equivalent in the service area, multiplied by an expected wastewater flow rate of 100 gallons per capita per day, times a peaking factor that accounts for diurnal variation. If the existing capacity is less than the anticipated amount of wastewater, the Village Engineer will design a sanitary sewer replacement project that provides the necessary capacity. This project would require a WMO permit from the MWRD.

V. Sewer System Inspection/Condition Assessment

A major component of the Village of Sunnybrook's sanitary sewer maintenance program is inspection and condition assessment of gravity lines, manholes, force mains, lift stations, and service laterals. Such facilities are inspected during construction and must meet the design requirements before the Village allows them to be placed into use. However, with the exception of most service laterals, these facilities are also inspected on a routine basis throughout their useful life. Systematic inspection that identifies defects and codes them in a consistent manner according to severity allows for cost-effective planning of sewer rehabilitation, repair, and replacement activities. The Village of Sunnybrook inspects all components of the public sewer system on a ten year cycle, with more frequent inspections in high priority portions of the system. Inspections of the public sewer system are performed in accordance with NASSCO standards.

The Village of Sunnybrook has a contract for CCTV services that is re-advertised every two years. The contractor televises approximately 20% of the Village's sanitary sewer system every two years in addition to emergency televising of segments of the sanitary sewer system where problem areas requiring immediate action are suspected. The contractor provides a digital video of all inspections along with an inspection report and condition assessment in accordance with NASSCO reporting guidelines.

As stated above, portions of the sanitary sewer system are inspected on a 3 year cycle while most of the system is inspected on a 10 year cycle. The Sewer Division has designated the portions of the system on the 10-year cycle that are to be inspected in each year of the 10 year cycle. The Sewer Division reviews inspection reports received from the Contractor and updates the Status of High Priority Defects and CIP on an annual basis. In general, the Sewer Division's goal is to address the defects with NASSCO grades of 4 or 5 within the next two years. However, this cannot always be achieved efficiently using Village staff or by including work under a rehabilitation or replacement contract. When developing the CIP each year, high priority defects that have been known for the longest period of time are given top priority.

Projects involving new sanitary sewer construction, or modification of existing sanitary sewers, must comply with the Village's and the MWRD's design requirements. The Village's Sewer Use Ordinance gives the Village the authority to inspect new sewer construction and establish standards by which sewers tributary to its system must comply. New public sanitary sewer construction projects are either designed by the Village Engineer or are designed by an outside consultant but reviewed by the Village Engineer for compliance with the Village's standards. A permit from the Village and from the MWRD is required for public sanitary sewer work when the work is not performed by the Village's own contractor. When work is performed by the Village's contractor, only a permit from the MWRD is required. Construction work is observed by the Village's Inspector.

Projects involving new private sector sanitary sewers require permits from the VIllage and from the MWRD. The Village Engineer reviews drawings of proposed conditions for compliance with Village standards. The Village Inspector observes construction work for compliance with approved permit drawings. An occupancy permit is not issued unless all Village requirements have been satisfied and after the Village receives an executed copy of the MWRD's Request for Final Inspection.

The procedure for inspection of new construction for which the Village issues a permit is as follows:

1. After reviewing the project drawings and receiving the permit fee, the Village issues a sewer construction permit. One term of the permit is to notify the Village Inspector a minimum of two days before sewer construction work begins.
2. Upon receipt of the notice that sewer construction work will begin, the Inspector visits the construction site on a daily basis to observe progress and quality of work. Revisions to the design are to be submitted to the Village by the Design Engineer for approval. If the Village Inspector observes deviations from the approved design in the field, he will notify the contractor and design engineer. If action is not take to correct the deviation, the Village may issue a violation notice to the contractor and project owner. Failure to properly address deviations from the approved design is justification for the Village to withhold an occupancy permit.
3. When the sewer construction work is complete, the project owner submits a Request for Testing to the Inspector. If requested by the Inspector, the Contractor must perform an air pressure test or an infiltration test to demonstrate that the required level of water-tightness has been achieved. If the required level of water-tightness is not achieved, the Contractor must repair the defects in the installation to reach the required level of water-tightness, and demonstrate compliance through additional testing. Once the Inspector has verified that the sewer installation has adequate water-tightness and all other aspects of sewer construction meet Village standards, the Inspector signs the

Request for Testing and provides a copy to the Village Building Department, the Contractor, the property owner, and the Design Engineer.

4. The Contractor submits the As-Built drawings to the Inspector. The Inspector reviews the drawings and issue a letter acknowledging receipt of the As-Built drawings or identifying deviations from the approved design. The As-Builts must be corrected and acknowledged by the Inspector before the Village will allow the new installation to be placed into service.
5. When the Village receives the fully executed RFI from the MWRD as well as signed compliance forms from other Village departments, as applicable to the project, the Village Building Department issues an occupancy permit.
6. If sewers and manholes have been built by a private party that are to be owned by the Village as part of its public sanitary sewer system, a transfer agreement is prepared and executed. Upon execution of the transfer agreement, the Sewer Division assigns a unique identification number to any newly added manholes and provides information on the new facilities to the GIS coordinator for updating of the sanitary sewer atlas.

A checklist for inspection of new sanitary sewer facilities is attached as Appendix A.

VI. Sewer System Rehabilitation and Updating the CIP

Several factors are taken into consideration when the annual update to the CIP is made by the Sewer Division. These include:

- Location, quantity and nature of High Priority Deficiencies
- Location of street pavement improvement projects for the year
- Available funding
- Age of sewers with High Priority Deficiencies
- Expected impact of sewer failure

The Sewer Division reviews inspection reports received from the sewer televising contractor and updates the Status of High Priority Defects and CIP on an annual basis. In general, the Sewer Division's goal is to address the defects with NASSCO grades of 4 or 5 within the next two years. However, this cannot always be achieved efficiently using Village staff or by including work under a rehabilitation or replacement contract. When developing the CIP each year, high priority defects that have been known for the longest period of time are given top priority. To minimize disturbances to the public and to optimize resources, wherever possible, the Village tries to perform sanitary sewer rehabilitation work in conjunction with street pavement improvement projects. When this coordination is possible, the Village will line or replace service lateral connections to the public sanitary sewer (up to 6 feet from the connection).

The Superintendent of Sewers, Village Engineer, and Director of Public Works meet once per year to review potential capital improvement projects based on the factors mentioned above. Small scope repairs can be accomplished with in-house staff (manhole cone section reconstruction, frame and grate replacement, plugging of leaks in manholes, joint sealing), but rehabilitation is performed under a competitively bid contract. Once the scope of the capital improvement projects are determined, the Village Engineer designs the projects or oversees the work of an outside consultant hired to design the project.

Once rehabilitation or sewer replacement projects have been completed, the Village Engineer provides information to the GIS coordinator to have the sewer atlas updated with relevant information.

VII. Funding plan

In July of 1992, the Village of Sunnybrook developed and implemented a Sewer Use Charge Fee. This fee has been, and will be, used to fund normal operations and maintenance, as well as most capital improvements to the sanitary sewer system. The fee establishes rates for residential, commercial and industrial users based on water usage. Industrial users are subject to additional surcharges if they discharge wastewater with high concentrations of BOD, TSS, or ammonia.

The Sewer Division budget is comprised of line items for personnel, contract services, supplies, equipment replacement and maintenance, training, rehabilitation contracts, replacement contracts, vehicle fuel and maintenance, and emergency repairs and service. The Superintendent maintains records of expenditures in each of these line items in past years, the projected expenditures in the current year, and a running total of expenditures in the current year. Projected expenditures for the next year are made based on a review of recent trends and on an assessment of short term needs, such as significant rehabilitation work. Every year, at least 4% of the annual revenue is set aside for capital improvement projects.

The Village will consider applying for assistance through the State Revolving Loan Fund for large capital improvement projects where the effort allocated towards preparing planning documents, filling out the application, and submitting all the required documentation of work performed is justified by the amount of the loan.

VIII. Private Sector Program
(*Submitted separately to the MWRD*)

IX. Sewer Use Ordinance

A copy of the Village's Sewer Use Ordinance is attached. The Sewer Use Ordinance was last updated in January 2015. The Village Board may authorize amendments to the Sewer Use Ordinance at their regularly scheduled public meetings as long as public notice of the proposed changes have been made available at least one week before the scheduled public meeting. Changes to the ordinance are recommended by the Village Engineer, generally after discussion of the need for the change among the Village Engineer, Director of Public Works, and the Superintendent. As stated earlier, the Village Engineer and Inspector have responsibility for administering and enforcing the Sewer Use Ordinance for new sanitary sewer construction. The Superintendent has responsibility for administering and enforcing the Sewer Use Ordinance for existing public and private sanitary sewers.

Appendix A of LTOMP: Sanitary Sewer Inspection Checklist

Village of Sunnybrook Department of Public Works

Sewers Division

The following items are to be checked by the Village Inspector during sanitary sewer construction. A completed version of this form is to be submitted with the signed Request for Testing when sanitary sewer construction is completed and acceptable to the Village Inspector.

Project Name:

Permit Number: Project Location:

Feature	Compliant	Non-Compliant	Comments
Gravity Sewer Line			
Pipe size	☐	☐	
Pipe material	☐	☐	
Pipe joints	☐	☐	
Bedding material	☐	☐	
Bedding thickness	☐	☐	
Backfill material	☐	☐	
Backfill compaction	☐	☐	
Line and grade	☐	☐	
Grade of manhole frame(s) and cover(s) with respect to finished grade	☐	☐	
Booted connections between sewer pipe and manholes	☐	☐	
Location and crossings with respect to water mains	☐	☐	
Lift Stations			
Control system	☐	☐	
Stand by power system	☐	☐	
System does not allow simultaneous pump operation	☐	☐	
Force Mains	☐	☐	
Pipe material	☐	☐	
Restrained joints or thrust blocks	☐	☐	
Air release valves at high points	☐	☐	
Residential Projects			
Separate sanitary and	☐	☐	

stormwater sumps, pumps, piping and discharge			
Discharge for sanitary sewage			
Discharge for stormwater			
Outlet for foundation drains			
Swimming pool discharge			

Test method: □ Visual □ Infiltration □ Exfiltration □ Air Pressure □ CCTV □ Other

Test information: □ Tested on same day □ Partial tests □ All tests passed □ Some tests failed

The undersigned hereby certifies that the project above has been tested as shown, and that the test results are as indicated herein.

Date of Test: ______________________________

Inspector Name:____

Inspector's signature:____