

Town of North Greenbush, New York

Stormwater Management Program Plan

June 01, 2021

Town of North Greenbush New York

Stormwater Management Program (SWMP) Plan

Introduction and Overview

Latest Revision: June 01, 2021

INTRODUCTION

Stormwater is challenging to manage in urbanized areas where runoff from rain events and melting snow can quickly flow over poorly infiltrating or impervious areas into lakes, streams and rivers. This issue becomes especially important when stormwater collects and transports pollutants such as soils, road salt, pesticides, fertilizers, petroleum products, antifreeze, animal waste, and litter into our surface waters impacting water quality, wildlife, and recreational areas.

In March 2003, the Town of North Greenbush (Town) developed an initial Stormwater Management Program (SWMP) to comply with the New York State Department of Environmental Conservation (DEC) Municipal Separate Storm Sewer System (MS4) program and a Notice of Intent (NOI) was submitted to DEC allowing the Town to discharge stormwater under a State Pollutant Discharge Elimination Program (SPDES).

The Town is a member of the Rensselaer County Stormwater MS4 Communities Coalition, which is a forum for the regulated communities to share resources and work in partnership toward compliance with the EPA Phase II Stormwater requirements. The overall goal of the Rensselaer County Stormwater MS4 Communities Coalition is to utilize regional collaboration to identify existing resources and develop programs to reduce the negative impacts of stormwater pollution and ultimately improve the water quality of our streams and lakes.

The Town updates the Stormwater Management Program on an annual basis and as required by the MS4 Program. The SWMP contains Best Management Practices, local laws, procedures, maps and other policies intended to educate and inform the public.

To review current stormwater documentation, submissions, policies, and information, visit the Town of North Greenbush website at www.townofng.com and under the Departments heading, select Stormwater from the drop-down menu.

If you have any questions or concerns about the stormwater management program for the Town, please send your comments to Eric Westfall, Stormwater Management officer, at EWestfall@northgreenbush.org. If you know of an illicit discharge or connection, please contact the Town of North Greenbush Building Department at (518) 283-2714 immediately.

OVERVIEW

The Town's SWMP Plan is based on NYS SPDES General Permit GP 0-15-003, which requires MS4 owners and operators to develop a Stormwater Management Program Plan to address sources of potential stormwater pollution from residential and municipal activities as well as municipal facilities. There are six program elements associated with the General Permit that are designed to reduce the discharge of pollutants to the maximum extent possible (MEP) through the implementation of Best Management Practices (BMPs). These program elements, titled Minimum Control Measures (MCMs), are as follows:

- MCM 1: Public Education and Outreach
- MCM 2: Public Involvement / Participation
- MCM 3: Illicit Discharge Detection and Elimination
- MCM 4: Construction Site Runoff Control
- MCM 5: Post-Construction Stormwater Management
- MCM 6: Pollution Prevention/Good Housekeeping for Municipal Operations

Each Minimum Control Measure and the associated Best Management Practices that have been planned or implemented by the Town are included within this SWMP Plan. For each MPM the measured goals, procedures and practices, responsibilities, and other material are outlined within this section and further defined in the attached and referenced appendices.

Minimum Control Measure 1: Public Education and Outreach

1.1: Scope:

MCM 1: Public Education and Outreach, consists of BMPs that focus on the development and distribution of educational materials designed to inform the public about the impacts that stormwater discharges have on local waterbodies. The Town's Public Outreach Program and associated BMPs are expected to reach all concerned and active residents within the Town and the educational material is intended to inform the public, including businesses conducting operations within the MS4's permitted boundary, of ways in which they can actively participate in reducing pollutants and their impact on the environment.

1.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must:

1.2.A: Requirement:

Develop and implement an ongoing public education and outreach program designed to describe to the general public, businesses, and other target audiences: the impacts of stormwater discharges on waterbodies; Pollutants of Concern (POCs) and their sources; steps that contributors of POCs can take to reduce pollutants in stormwater runoff; and steps that contributors of non-stormwater discharges can take to reduce pollutants.

Steps to Address:

The Best Management Practices, planned or implemented, are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 1: Public Presentation: Town of North Greenbush's Stormwater Management Plan.
- Exhibit 2: Pollutants of Concern.
- Exhibit 3: Spill Response Procedures.
- Exhibit 4: Current General Permit (Reference).

1.2.B: Requirement:

Identify Target Audiences.

Steps to Address:

Although addressed directly or indirectly within several Exhibits, the following Targeted Audiences have been identified for the public education and outreach program:

- Residents.
- Commercial Businesses such as restaurants, offices, salons, and retail establishments.

- Automotive Businesses including gas stations, repair shops, and car washing and detailing establishments.
- Institutions such as medical facilities, schools, churches and funeral homes.
- Developers and contractors.
- Industrial and Manufacturing facilities.
- Municipal Operations.

1.2.C: Requirement:

Identify Pollutants of Concern.

Steps to Address:

Pollutants of Concern are discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 2: Pollutants of Concern.

1.2.D: Requirement:

Identify Waterbodies of Concern.

Steps to Address:

Waterbodies of Concern are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 5: Waterbodies of Concern.
- Exhibit 6: Snyders Lake Water Quality and Best Management Practices.

1.2.E: Requirement:

Identify Geographic Area of Concern.

Steps to Address:

Geographic Areas of Concern are discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 7: Geographic Areas of Concern.

1.2.F: Requirement:

Develop, record, periodically assess, and modify as needed, measurable goals.

Steps to Address:

This item is addressed in the submission of the Town’s MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

1.2.G: Requirement:

Select appropriate education and outreach activities and measurable goals to ensure the reduction of Pollutants of Concern in stormwater discharges.

Steps to Address:

The Best Management Practices, planned or implemented, are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 1: Public Presentation: Town of North Greenbush’s Stormwater Management Plan.
- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

1.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 1 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Present the revised SWMP Plan and 2021 MS4 Annual Report to the Town Board, Planning Board, and public during live or zoom meetings	Familiarize individuals with the SWMP Plan, MS4 Reporting process, and general stormwater management practices utilized by the Town	Municipal Leaders, Residents, Homeowners, Businesses and Contractors	Conduct at least four public / municipal meetings to review and discuss the SWMP Plan
Continue with the development, distribution, and public presentation of Stormwater education materials at Town Board and Planning Board Meetings and posting at Town Offices	Raise awareness and change behavior regarding Stormwater	Residents, Homeowners, Businesses and Contractors	Prepare and make available at least four brochures related to stormwater management
Posting of potential Stormwater notices on	Raise awareness and change behavior regarding Stormwater	Residents, Homeowners,	Track sign displays

Town electronic display board		Businesses and Contractors	
Develop and populate the Stormwater page on the Town's Website	Raise awareness and provide an easy-to-access area for Stormwater information within the Town	Residents, Homeowners, Businesses and Contractors	Track Stormwater page development, number of items posted, and comments received
Continue the formation of groups and committees for residents to become involved in and help with education and awareness of Stormwater issues	Provide an avenue for residents to take an active part in Stormwater education and awareness	Residents, Homeowners and Businesses	Track community involvement
Long-Term Goals			
Continue with work as a Climate Smart Community	Move forward with Climate Smart agenda	Residents, Homeowners, Businesses and Contractors	Continued participation and recognition as a Climate Smart Community
Identify waterbodies of concern	Determine which bodies of water within the Town are of greatest concern with regard to stormwater and water quality issues	Residents, Homeowners, Businesses and Contractors	Map waterbodies of concern and develop a plan for monitoring these items, including possible funding for studies
Identify geographic areas of concern	Determine geographic areas of concern within the Town as they relate to stormwater and water quality issues	Residents, Homeowners, Businesses and Contractors	Map geographic areas of concern and develop a plan for monitoring these items, including possible funding for studies

1.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town's website and within the annual MS4 report, as required.

- Brochures and other educational material posted at the Town offices or on the Stormwater web page.
- Forums, educational presentations and public discussions related to the SWMP and other stormwater or environmental topics
- Quantity and type of e-mails received by the Stormwater Management Officer and the number of potential stormwater violations investigated.
- The number and type of resident-based committees addressing stormwater and environmental issues.

Minimum Control Measure 2: Public Involvement/Participation

2.1: Scope:

MCM 2: Public Participation/Involvement, consists of BMPs that focus on encouraging and supporting members of the local community to get involved in the MS4's stormwater management program. The BMPs have established a number of practices designed to seek public input and participation in the SWMP and MS4 Annual Report process. The Target Audience for the public involvement program include the general public, businesses, and individuals or groups that may have an interest in one or more of the BMPs. In several instances, the policies and practices of MCM 2: Public Involvement/Participation will overlap or integrate with MCM 1: Public Education and Outreach.

2.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must:

2.2.A: Requirement:

Comply with the State Open Meetings Law and local Public Notice requirements when implementing a public involvement/participation program.

Steps to Address:

The Town of North Greenbush complies with the State Open Meetings Law and local Public Notice requirements. Public meetings are live streamed and information and links are available at the Town's website: <https://townofng.com/>

2.2.B: Requirement:

Provide and present a copy of the MS4 Annual Report.

Steps to Address:

The Town has developed a Stormwater page within the Town website. To access this page, go to the Town website at <https://townofng.com/> and under the DEPARTMENTS tab simply scroll down to Stormwater. On this page, the Town posts educational documents, bulletins, the MS4 Annual Report, the SWMP Plan, and other items related to stormwater topics. Additionally, there is a phone number as well as a link to allow residents to contact the Town Stormwater Management Officer. When the Town's MS4 Annual Report has been prepared, the Town will present this document at the June Town Board meeting in addition to posting it on the Town website. The Town will accept comments and questions on the Report and will address these items as necessary.

2.2.C: Requirement:

Provide the opportunity for the public to participate in the development, implementation, review and revision of the SWMP.

Steps to Address:

The Town has developed a Stormwater page within the Town website. To access this page, go to the Town website at <https://townofng.com/> and under the DEPARTMENTS tab simply scroll down to Stormwater. On this page, the Town posts educational documents, bulletins, the MS4 Annual Report, the SWMP Plan, and other items related to stormwater topics. Additionally, there is a phone number as well as a link to allow residents to contact the Town Stormwater Management Officer. When the Town's MS4 Annual Report is posted, the Town will present this document at the June Town Board and Planning Board meetings, and at that time will indicate that it has posted and is soliciting comments for revisions to the current year's SWMP Plan. Submitted comments will be compiled and reviewed by the Stormwater Management Officer and will be incorporated, as appropriate, into the revised SWMP Plan. A revised version of that year's SWMP will be presented during the August Town Board Meeting and posted on the Stormwater web page. The procedure for reviewing and updating the SWMP is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 10: SWMP Review and Update Procedures.

2.2.D: Requirement:

Identify a local contact for public concerns regarding stormwater management and compliance with the General Permit. This shall include a written description of the established procedures for the receipt, follow-up, and documentation of complaints or other information submitted by the public regarding construction site stormwater runoff, as well as the means for addressing these concerns and the actions to be taken to ensure that corrective measures are implemented.

Steps to Address:

The Town has developed a Stormwater page within the Town website. To access this page, go to the Town website at <https://townofng.com/> and under the DEPARTMENTS tab simply scroll down to Stormwater. On this page, the Town posts educational documents, bulletins, the MS4 Annual Report, the SWMP Plan, and other items related to stormwater topics. Additionally, there is a phone number as well as an e-mail address to allow residents to contact the Town Stormwater Management Officer. The procedure for addressing stormwater concerns submitted by the public is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 11: Public Concerns Investigation Procedure.

2.2.E: Requirement:

Develop, record, periodically assess, and modify as needed, measurable goals.

Steps to Address:

This item is addressed in the submission of the Town’s MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

2.2.F: Requirement:

Select appropriate education and outreach activities and measurable goals to ensure the reduction of Pollutants of Concern in stormwater discharges.

Steps to Address:

The Best Management Practices, planned or implemented, intended to reduce or manage Pollutants of Concern to the MEP are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 1: Public Presentation: Town of North Greenbush’s Stormwater Management Plan.
- Exhibit 2: Pollutants of Concern.
- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

2.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 2 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Post and facilitate public review of MS4 Annual Report	Actively engage public in the activities undertaken as part of the MS4 by reviewing the submitted report	Residents, Homeowners, Businesses and Contractors	Collection of public comments on MS4 Annual Report
Post and facilitate public review of SWMP Plan	Actively engage public by allowing review and comments of annual SWMP and SWMP revision process	Residents, Homeowners, Businesses and Contractors	Collection of public comments on SWMP Plan
Increase efforts to have more residents join committees or activities associated with	Actively engage public in the shaping of stormwater policy	Residents	Work with Town Board and Planning Board to track community involvement

stormwater management issues			
Continue to investigate public concerns submitted to Stormwater Management Officer	Provide the public with the opportunity to report potential stormwater violations and to express concerns or ask questions	Residents, Homeowners, Businesses and Contractors	Track emails and phone calls sent to the Stormwater Management Officer
Long-Term Goals			
Public participation in Stormwater Policy	Establishment of committees for Stormwater education and review of Stormwater policies and BMPs	Residents, Homeowners, Businesses and Contractors	Track public participation

2.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town’s website and within the annual MS4 Report, as required.

- The manner in which the annual MS4 Report is presented to the public, including dates, and any comments received from the community.
- The manner in which the SWMP is annually updated, presented to the public, including dates, and any comments received from the community.
- The number of public participants in Town committees and activities.
- Statistical tracking and categorization of concerns submitted to the Stormwater Management Officer, investigative actions taken, and corrective or enforcement measures enacted.

Minimum Control Measure 3: Illicit Discharge Detection and Elimination

3.1: Scope:

MCM 3: Illicit Discharge Detection and Elimination (IDDE), consists of BMPs intended to address the detection and elimination of illicit discharges within the MS4. The BMPs concentrate on policies and procedures that include establishing and updating outfall mapping, legal means for prohibiting illicit discharges, dry weather screening for outfalls, tracking down illicit discharge sources, enforcement procedures, and the processes for removing illicit discharge sources.

3.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must:

3.2.A: Requirement:

Develop, implement and enforce a program to detect and eliminate illicit discharges into the boundaries of the MS4.

Steps to Address:

The Town is in the process of refining its IDDE program, which is based generally on the publication, “*Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*,” as well as the, “*Technical Appendices*.” This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 12: Illicit Discharge Detection and Elimination Program.

3.2.B: Requirement:

Develop and maintain a map, at a minimum within the permittee’s jurisdiction in the urbanized area and additionally designated areas.

Steps to Address:

The Town is in the process of updating its GIS baseline map. Upon completion, the map will be used to indicate designated areas, outfalls, stream mapping, IDDE points, stormwater management areas, waterbodies of concern, geographic areas of concern and other stormwater elements. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 13: Illicit Discharge Detection and Elimination Mapping.

3.2.C: Requirement:

Field verify outfall locations.

Steps to Address:

The Town is in the process of updating its GIS baseline map. Upon completion, the map will be used to indicate designated areas, outfalls, stream mapping, IDDE points, stormwater management areas, waterbodies of concern, geographic areas of concern and other stormwater elements. Currently, the Town uses an existing map and spreadsheet to indicate outfall locations, which will be verified as part of the creation of the new map. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 14: Outfall Mapping.

3.2.D: Requirement:

Conduct an outfall reconnaissance survey, addressing every outfall within the MS4's jurisdiction.

Steps to Address:

The requirement specifies that reconnaissance and inspection for all outfalls shall occur at least once every five years, with reasonable progress occurring each year. The Town attempts to improve upon this minimum 20% requirement each year to accommodate the potential of new outfalls being discovered. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 15: Outfall Inspection and Monitoring Procedures.

3.2.E: Requirement:

Map new outfalls as they are constructed or newly discovered within the MS4's jurisdiction.

Steps to Address:

The Town is in the process of updating its GIS baseline map. Upon completion, the map will be used to indicate designated areas, outfalls, stream mapping, IDDE points, stormwater management areas, waterbodies of concern, geographic areas of concern and other stormwater elements. Currently, the Town uses an existing map and spreadsheet to indicate outfall locations, which will be verified as part of the creation of the new map. New outfalls will be added to the mapping system as they are constructed or discovered. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 14: Outfall Mapping.

3.2.F: Requirement:

Prohibit, through a law, ordinance, or other regulatory mechanism, illicit discharges into the MS4 and implement appropriate enforcement procedures and actions.

Steps to Address:

The Town has adopted Local Law No. 2 of the Year 2008: Illicit Discharges, Activities and Connections to the Town of North Greenbush's Municipal Separate Storm Sewer System. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 16: Local Law No. 2 of the Year 2008: Illicit Discharges, Activities and Connections to the Town of North Greenbush's Municipal Separate Storm Sewer System.

3.2.G: Requirement:

Develop and implement a program to detect and address non-stormwater discharges, including illegal dumping within the MS4.

Steps to Address:

The Town intends to detect non-stormwater discharges and illegal dumping through the Illicit Discharge Detection and Elimination Program, Outfall Inspections, and the Public Concerns Investigation Procedure. This item is discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 11: Public Concerns Investigation Procedure.
- Exhibit 12: Illicit Discharge Detection and Elimination Program.
- Exhibit 15: Outfall Inspection and Monitoring Procedures.

3.2.H: Requirement:

Inform the general public, businesses and municipal employees of the hazards associated with the illegal discharge and improper disposal of waste.

Steps to Address:

In addition to the material covered during the Town's Public Presentation for the SWMP, the Stormwater web page will also contain information and brochures associated with illicit discharges and the improper disposal of residential, industrial, commercial and construction wastes. This item is discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 1: Public Presentation: Town of North Greenbush's Stormwater Management Program.
- Exhibit 17: Illicit Discharge Detection and Elimination Public Awareness Program.

3.2.I: Requirement:

Address the categories of non-stormwater discharges or flows as necessary.

Steps to Address:

The Town recognizes the potential for non-stormwater discharges to occur. While continuing to locate and identify illicit discharges, the Town Stormwater Management Officer will annually update the Town's list of exempt discharges and to verify that such discharges do not substantially contribute pollutants to drainage systems and waterbodies. The list of exempt Non-Stormwater Discharges is included in the following Exhibit, included as an attachment to this SWMP:

- Exhibit 18: Exempt Non-Stormwater Discharges.

3.2.J: Requirement:

Develop, record, periodically assess, and revise measurable goals, as needed.

Steps to Address:

This item is addressed in the submission of the Town's MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush's MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

3.2.K: Requirement:

Select appropriate IDDE BMPs and measurable goals to ensure the reduction of Pollutants of Concern in stormwater discharges.

Steps to Address:

The Best Management Practices, planned or implemented, intended to reduce or manage Pollutants of Concern to the MEP are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 1: Public Presentation: Town of North Greenbush's Stormwater Management Plan.
- Exhibit 2: Pollutants of Concern.
- Exhibit 8: Town of North Greenbush's MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.
- Exhibit 12: Illicit Discharge Detection and Elimination Program

3.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 3 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Implement IDDE Program	Use inspections, mapping, Stormwater web page, e-mail reporting, and Local IDDE Law to identify and eliminate illegal discharges	Residents, Homeowners, Businesses and Contractors	Track IDDE program inspection and mapping progress as indicated in SWMP Exhibits (30% mapping of waterbodies)
Implement Outfall Mapping (Audit) Program	Update Outfall Mapping on a regular basis as new outfalls are identified during inspections or added as part of development	Residents, Homeowners, Businesses and Contractors	Conduct field inspections, verifications and mapping as per SWMP Exhibits (103 outfalls)
Increase Training for Relevant Municipal (Field) Staff	Increase employee awareness of IDDE/Outfall Programs	Municipal Employees	Track training of employees (target 2 classes minimum)
Review Non-Stormwater Discharge list	Review list of exempt discharges annually	Residents, Homeowners, Businesses and Contractors	Update list every other year in SWMP Exhibit 18
Long-Term Goals			
IDDE Mapping	Conduct inspections of Town waterbodies for signs of illicit discharges. Goal is to inspect 20%-25% of waterbodies annually	Residents, Homeowners, Businesses and Contractors	Updating IDDE Map regularly for inclusion in MS4 Report Annual Submission
IDDE Training Program	Develop and institute and IDDE Program for Building and Highway Department personnel	Town Employees	Add training program to IDDE agenda and Exhibits

3.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town’s website and within the annual MS4 Report, as required.

- The updated Outfall and Illicit Discharge maps and spreadsheets used to track and inspect IDDE Program elements.
- The number of Illicit Discharges encountered and addressed.
- Annual updates to the SWMP and MS4 report.

Minimum Control Measure 4: Construction Stormwater Management

4.1: Scope:

MCM 4: Construction Stormwater Management BMPs focus on the reduction of pollutants to the MS4 that are the result of construction activities from land disturbances of one acre or greater, or less than one acre if the disturbance is part of an overall construction project that would disturb more than one acre. Pollutants commonly discharged from construction sites include: sediment, oil and grease, concrete truck washout, solid waste, sanitary waste, phosphorous and nitrogen (fertilizers), chemicals, and construction debris. Sediment is typically the most common pollutant released from construction sites and often substantially exceeds sediment released from other activities such as agriculture and natural soil erosion.

To minimize the impact of construction activities within the MS4, BMPs are implemented to contain or control the release of pollutants. The BMPs discussed within the MCM outline:

- Requirements for construction site operators to implement erosion and sediment control BMPs;
- Requirements for construction site operators to control discarded building materials, chemicals, concrete washouts, litter, sanitary waste, and other such waste;
- Procedures for site plan reviews;
- Procedures for receiving and reviewing public input;
- Construction site inspection and the enforcement of control measure implementation and upkeep; and,
- The legal mechanism in which BMPs are specified and enforced.

Stormwater regulations for MCM4 apply to privately-owned and managed projects as well as municipal (MS4) projects.

4.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must develop, implement, and enforce a program that:

4.2.A: Requirement:

Provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from construction activities per the requirements general SPDES Permit GP-0-15-003.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 4: Current General Permit.

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

The Local Law addresses issues related to:

- Erosion and sediment control measures and maintenance.
- SWPPP content, review and amendment as well as design and performance standards.
- Plan certification.
- Contractor certification.
- Inspections.
- Project completion and post-construction activities.

4.2.B: Requirement:

Addresses stormwater runoff to the MS4 from construction activities that result in a land disturbance of one acre or more. The control of stormwater discharges from construction activities disturbing less than one acre must be included in the program if the construction activities are part of a larger common plan of development or sale that would disturb one acre or more.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

4.2.C: Requirement:

Includes a law, ordinance or other regulatory mechanism to require a SWPPP for each applicable land-disturbing activity that includes erosion and sediment controls that meet the State's most current technical standards.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

4.2.D: Requirement:

Contains requirements for construction site operators to implement erosion and sediment control management practices.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

4.2.E: Requirement:

Allows for sanctions to ensure compliance to the extent allowable by State or local law.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

4.2.F: Requirement:

Contains requirements for construction site operators to control waste such as litter, chemicals, discarded building materials, concrete truck washout, sanitary waste, and other similar materials at the construction site that may cause adverse impacts to water quality.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

4.2.G: Requirement:

Describes procedures for SWPPP review that consider potential water quality impacts and review of individual pre-construction SWPPPs to ensure compliance with State and local sediment and erosion control requirements.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. Additionally, the Town has a general guidance document outlining the SWPPP Submission and Review Process. These items are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.
- Exhibit 20: SWPPP Submission and Review Process.

4.2.H: Requirement:

Describes procedures for receipt and follow-up on complaints or other information submitted by the public regarding construction site stormwater runoff.

Steps to Address:

The Town has developed a Stormwater page within the Town website. To access this page, go to the Town website at <https://townofng.com/> and under the DEPARTMENTS tab simply scroll down to Stormwater. On this page, the Town posts educational documents, bulletins, the MS4 Annual Report, the SWMP Plan, and other items related to stormwater topics. Additionally, there is a phone number as well as an e-mail address to allow residents to contact the Town Stormwater Management Officer. The procedure for addressing stormwater concerns submitted by the public is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 11: Public Concerns Investigation Procedure.

4.2.I: Requirement:

Educates construction site operators, design engineers, inspectors, municipal staff, and other individuals involved in stormwater management for a project about the construction requirements in the MS4's jurisdiction, including procedures for the submission of a SWPPP, construction site inspections, and other procedures associated with the control of construction stormwater.

Steps to Address:

The Town conducts pre-construction SWPPP meetings during which the SWPPP requirements and expectations are outlined. At this time, the Town also collects contact information and copies of certifications for various individuals associated with the design, construction, management and inspection processes. Additionally, the Town reviews the construction site inspection process as well as the post-construction inspection and project closure process. These items are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 21: SWPPP Pre-Construction Meeting and Training Verification.
- Exhibit 22: SWPPP Inspection and Enforcement Policy.
- Exhibit 23: SWPPP Inspection and Enforcement Policy

4.2.J: Requirement:

Ensures that construction site contractors have received erosion and sediment control training before performing work within the MS4.

Steps to Address:

These items are collected at or before the pre-construction kickoff meeting. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 21: SWPPP Pre-Construction Meeting and Training Verification.

4.2.K: Requirement:

Establishes and maintains an inventory of active construction sites, including the location of the site, owner/operator contact information and Permit Number.

Steps to Address:

The Town maintains a tracking spreadsheet for stormwater projects occurring within the MS4. This spreadsheet is updated during the Town's Monthly SWPPP inspections. This item is discussed within the following Exhibit, included as attachment to this SWMP:

- Exhibit 24: Stormwater Permit Tracking Spreadsheet.

4.2.L: Requirement:

Develop, record, periodically assess, and revise measurable goals, as needed.

Steps to Address:

This item is addressed in the submission of the Town's MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

4.2.M: Requirement:

Select appropriate construction stormwater BMPs and measurable goals to ensure the reduction of Pollutants of Concern in stormwater discharges.

Steps to Address:

The stormwater Best Management Practices, planned or implemented, intended to reduce or manage Pollutants of Concern in stormwater discharges to the MEP are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.
- Exhibit 22: SWPPP Inspection and Enforcement Policy.

4.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 4 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Adopt revised Local Law No. 1 of Stormwater Management and Erosion and Sediment Control	Finish public review and Town Board approval for new local law	Residents, Homeowners, Businesses and Contractors	Passing of revised Local Law
Continue to audit SWPPP Review process	Revise SWPPP review process for interaction between TDE and Town Engineer/Stormwater Management Officer	Stormwater Management Officer	Revise SWPPP Review process and update Exhibit 20
Improve Town monthly SWPPP inspection procedure and tracking	Improve efficiency and electronic storage of Town monthly SWPPP inspections	Municipal inspectors	Monthly update active projects tracking spreadsheet and Town archives of inspections for MS4 Annual Report
Continue Training for Relevant Municipal (Field) Staff	Increase employee awareness of Stormwater Runoff Controls	Municipal Employees	Track training of employees (target 2 classes minimum)

Long-Term Goals			
SWPPP Enforcement	Implement a more formal and stringent policy regarding SWPPP enforcement, particularly as related to violations	Municipal inspectors, Stormwater Management Officer	Tracking via MS4 Annual Report

4.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town’s website and within the annual MS4 Report, as required.

- The revised Local Law No. 1 ó Stormwater Management and Erosion and Sediment Control.
- Copies of monthly SWPPP inspections in Town archive.
- Document training of employees.
- SWPPP Enforcement for violations noted on MS4 Annual Report.

Minimum Control Measure 5: Post-Construction Stormwater Management

5.1: Scope:

MCM 5: Post-Construction Stormwater Management BMPs focus on the prevention or minimization of water quality impacts from both new and redevelopment projects with land disturbances of one acre or greater, or less than one acre if the disturbance is part of an overall construction project that would disturb more than one acre. The BMPs are intended to describe structural and/or non-structural design and installation practices, the legal mechanism used to address post-construction runoff from new development and redevelopment projects, and the procedures and enforcement policies used to ensure the long-term operation and maintenance of stormwater control measures and BMPs.

5.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must develop, implement, and enforce a program that:

5.2.A: Requirement:

Provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from construction activities per the requirements general SPDES Permit GP-0-15-003.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 4: Current General Permit.
- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

The Local Law addresses issues related to:

- Erosion and sediment control measures and maintenance.
- SWPPP content, review and amendment as well as design and performance standards.
- Plan certification.
- Contractor certification.
- Inspections.
- Project completion and post-construction activities.

5.2.B: Requirement:

Addresses stormwater runoff associated with new development and redevelopment projects within the MS4 from construction activities that result in a land disturbance of one acre or

more. The control of stormwater discharges from construction activities disturbing less than once acre must be included in the program if the construction activities are part of a larger common plan of development or sale that would disturb one acre or more.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

5.2.C: Requirement:

Includes a law, ordinance or other regulatory mechanism requiring post-construction runoff controls from new development and redevelopment projects to the extent allowable under State or Local law that meet the State’s most current technical standards. The mechanism must be equivalent to one of the versions of the NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control, with equivalence being documented using the NYSDEC Gap Analysis Workbook or certified by the attorney representing the small MS4 as being equivalent to one of the local laws if one of the sample laws is not adopted or is a modified version of one of the sample laws is adopted.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

5.2.D: Requirement:

Includes a combination of structural or non-structural management practices in accordance with the standards established in the most current version of the NYS Stormwater Management Design Manual (SMDM) that will reduce the discharge of pollutants to the maximum extent possible. Items for design consideration should include natural resource protection, open space preservation, Low Impact Development, Green Infrastructure, impervious area reduction, natural hydrological condition maintenance, the protection of sensitive areas through buffers or setbacks and other elements as required or applicable that may be designed or installed in accordance the SMDM.

If a stormwater management practice is designed and installed in accordance with the SMDM, or has been demonstrated to be equivalent and is properly operated and maintained, then the

MEP will be assumed to be met for post-construction stormwater discharge by the subject practice.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. The Town continues to push for low-impact design and development, green infrastructure (the Town has recently been designated a Climate Smart Community), over-retention of stormwater, and other more natural stormwater management practices. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.

5.2.E: Requirement:

Describes procedures for SWPPP review that consider potential water quality impacts and addresses the review of individual pre-construction SWPPPs to maintain consistency with local post-construction stormwater requirements. The procedures should ensure that: individuals performing SWPPP reviews are competent, or under the supervision of a qualified professional; all SWPPPs are to be reviewed for sites where the area of disturbance is one acre or greater; and that after the review of a SWPPP, the permittee utilizes the “SWPPP Acceptance Form” developed by NYSDEC and as required by the SPDES General Permit for Stormwater Discharges from Construction Activity when notifying the construction site owner/operator that the plans have been accepted and approved by the permittee.

Steps to Address:

The Town currently has a Local Law to address Stormwater management and Erosion and Sediment Control. Furthermore, the Town has drafted a new law Based upon the NYSDEC Model Law, which is undergoing the review and public approval process. Additionally, the Town has a general guidance document outlining the SWPPP Submission and Review Process. These items are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control.
- Exhibit 20: SWPPP Submission and Review Process.

5.2.F: Requirement:

Establish and maintain an inventory of post-construction stormwater management practices that includes: the location of the practice; the type of practice; maintenance requirements per the SMDM or SWPPP; and the dates and type of maintenance performed. The inventoried practices shall include, at a minimum: practices discharging to the MS4 that have been

installed since March 10, 2003; all practices owned by the MS4; and practices found to cause or contribute to water quality violations.

Steps to Address:

The Town is in the process of developing a spreadsheet and map to track post-construction stormwater management practices. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 25: Post-Construction Stormwater Management Practices Inventory.

5.2.G: Requirement:

Ensures adequate long-term operation and maintenance of inventoried management practices by trained/qualified staff. This shall include assessments to verify that the practices are performing as designed or intended in compliance with the SMDM, SWPPP or other maintenance information. It should be noted that stormwater sample collection and testing/chemical analyses are not required for covered entities.

Steps to Address:

The Town utilizes the Stormwater Management Officer and other qualified municipal staff members as well as the TDE to conduct inspections of post-construction stormwater management practices. Stormwater management practices are either maintained by the Town Highway Department, the Town Utilities Department, or privately by the owner, and HOA or other similar entity. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 26: Post-Construction Stormwater Management Practices Inspection and Enforcement.

5.2.H: Requirement:

Recognizes that covered entities may include SWMP Plan provisions for the development of a banking and credit system.

Steps to Address:

At this time, the Town of North Greenbush has not evaluated this option.

5.2.I: Requirement:

Develops, implements, and provides adequate resources for a program to inspect development and post-development sites by trained staff, and to enforce and penalize violators.

Steps to Address:

The Town utilizes the Stormwater Management Officer and other qualified municipal staff members as well as the TDE to conduct inspections of post-construction stormwater management practices. This item is discussed within the following Exhibit, included as an attachment to this SWMP:

- Exhibit 26: Post-Construction Stormwater Management Practices Inspection and Enforcement.

5.2.J: Requirement:

Develops, records, periodically assesses and modifies measurable goals as required.

Steps to Address:

This item is addressed in the submission of the Town's MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush's MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

5.2.K: Requirement:

Selects appropriate post-construction BMPs and measurable goals to ensure the reduction of pollutants of concern in stormwater discharges to the maximum extent possible.

Steps to Address:

The stormwater Best Management Practices, planned or implemented, intended to reduce or manage Pollutants of Concern in stormwater discharges to the MEP are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 8: Town of North Greenbush's MS4 Annual Report.
- Exhibit 25: Post-Construction Stormwater Management Practices Inventory.
- Exhibit 26: Post-Construction Stormwater Management Practices Inspection and Enforcement.

5.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 5 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Continue Post-Construction Stormwater Management Practices Inventory Audit	Maintain active mapping	Stormwater Management Officer	Update Inventory Tracking Spreadsheet and Mapping to reflect existing and new Stormwater Practices
Strengthen Post-Construction Stormwater Management Practices Inspection program and enforcement policy for reporting	More complete inspection program	Stormwater Management Officer	Track inspections and enforcement documentation
Continue Training for Relevant Municipal (Field) Staff	Increase employee awareness of Post-Construction Stormwater Management Systems	Municipal Employees	Track training of employees (target 2 classes minimum)
Long-Term Goals			
Consider Post-Construction Stormwater Maintenance Ordinance	Clearer definition of requirements for practices ó better operation ó better for public	Public, Stormwater Management Officer, Municipal Employees	MS4 Annual Report (potentially)
Advance discussion on municipal versus privately-owned practices	Town may be approaching limit of number of practices that can be municipally maintained	Public, Stormwater Management Officer, Municipal Employees	MS4 Annual Report (potentially)

5.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town’s website and within the annual MS4 report, as required.

- Post-Construction Stormwater Management Practices Inventory spreadsheet and map.
- Progress of Post-Construction Stormwater Management Practices inspections.
- Document training of employees.

Minimum Control Measure 6: **Pollution Prevention and Good Housekeeping for Municipal Operations**

6.1: Scope:

MCM 6: Pollution Prevention and Good Housekeeping for Municipal Operations consists of BMPs that focus on the training of employees and the implementation of policies and procedures designed to prevent or reduce pollutant runoff associated with municipal operations. The various BMPs address training, maintenance, inspections, municipal operations, storage of materials, disposal of materials, and upkeep of Town facilities, parks and infrastructure elements.

6.2: Permit Requirements and Steps to Address:

To comply with General Permit Requirements, an MS4 must develop and implement a pollution prevention and good housekeeping program for municipal operations that:

6.2.A: Requirement:

Addresses municipal operations and facilities that actually or potentially contribute Pollutants of Concern to the MS4.

Steps to Address:

Municipal operations and facilities for the Town of North Greenbush include: municipal building maintenance; park and open space maintenance; stormwater system maintenance; street maintenance; solid waste management; vehicle and fleet maintenance; and winter road maintenance. The Town has developed a series of procedures to address these items as discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 27: Pollution Prevention and Good Housekeeping for Municipal Operations.
- Exhibit 28: Highway Department Vehicle and Garage Operation and Maintenance Procedures.
- Exhibit 29: Highway Garageø Fuel and Petroleum Storage Use and Procedures.
- Exhibit 30: Highway Garageø Salt Storage and Use Procedures.

6.2.B: Requirement:

Establishes a plan to perform a self-assessment of all municipal operations addressed by the SWMP at a minimum frequency of once every three years.

Steps to Address:

The BMPs outlined in Exhibits 27-30 are reviewed annually as part of the overall SWMP review process. These items will be more thoroughly self-assessed at least once every three years. This will be recorded in the revision block used to track SWMP Exhibits.

6.2.C: Requirement:

Develops management policies, procedures, etc. that can be implemented to reduce or prevent the actual or potential discharge of pollutants based primarily on the “NYS Pollution Prevention and Good Housekeeping Assistance Document.”

Steps to Address:

The Town has developed a series of procedures to address these items as discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 27: Pollution Prevention and Good Housekeeping for Municipal Operations.
- Exhibit 28: Highway Department Vehicle and Garage Operation and Maintenance Procedures.
- Exhibit 29: Highway Garageø Fuel and Petroleum Storage Use and Procedures.
- Exhibit 30: Highway Garageø Salt Storage and Use Procedures.

6.2.D: Requirement:

Prioritizes pollution prevention and good housekeeping efforts based: on geographic area; potential to improve water quality; facilities or operations most in need of modifications or upgrades; and the permittee’s capabilities.

Steps to Address:

The Town Stormwater Management Officer will work with the Town Highway, Town Utility and Building Department personnel to prioritize good housekeeping and pollution prevention efforts based on geographic areas, the potential to improve water quality, and facilities or operations most in need of modifications or improvements.

6.2.E: Requirement:

Addresses pollution prevention and good housekeeping practices and priorities.

Steps to Address:

The Town has developed a series of procedures to address these items as discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 27: Pollution Prevention and Good Housekeeping for Municipal Operations.
- Exhibit 28: Highway Department Vehicle and Garage Operation and Maintenance Procedures.
- Exhibit 29: Highway Garageø Fuel and Petroleum Storage Use and Procedures.
- Exhibit 30: Highway Garageø Salt Storage and Use Procedures

6.2.F: Requirement:

Establishes an employee pollution prevention and good housekeeping training program and ensures that staff receive and utilize training.

Steps to Address:

The Town Stormwater Management Officer will work with the Town Highway, Town Utility and Building Department supervisors to coordinate annual training in the applicable stormwater management areas as required to complete assigned tasks. In addition, the SWMP Plan will be reviewed with municipal employees each year following the submission of the MS4 Annual Report to discuss BMPs, SOPs and other policies to be implemented during daily work activities.

6.2.G: Requirement:

Requires third-party contracted services providers, including but not limited to: street sweeping, snow removal, lawn and grounds care, etc., to meet permit requirements as they apply to the services performed.

Steps to Address:

The Town Stormwater Management Officer will work with the Town Highway, Town Utility and Building Department supervisors to obtain third party certificates from contracted service companies. Certificates will be kept at the applicable department office.

6.2.H: Requirement:

Develops, records, periodically assesses and modifies measurable goals as required.

Steps to Address:

This item is addressed in the submission of the Town's MS4 Annual Report that is submitted to DEC and included as an attachment to this report:

- Exhibit 8: Town of North Greenbush's MS4 Annual Report.
- Exhibit 9: Developed Measurable Goals.

6.2.I: Requirement:

Selects appropriate pollution prevention and good housekeeping BMPs and measurable goals to ensure the reduction of pollutants of concern in stormwater discharges to the maximum extent possible.

Steps to Address:

The stormwater Best Management Practices, planned or implemented, intended to reduce or manage Pollutants of Concern in stormwater discharges to the MEP are discussed within the following Exhibits, included as attachments to this SWMP:

- Exhibit 8: Town of North Greenbush’s MS4 Annual Report.
- Exhibit 27: Pollution Prevention and Good Housekeeping for Municipal Operations.
- Exhibit 28: Highway Department Vehicle and Garage Operation and Maintenance Procedures.
- Exhibit 29: Highway Garage’s Fuel and Petroleum Storage Use and Procedures.
- Exhibit 30: Highway Garage’s Salt Storage and Use Procedures.

6.3: Best Management Practices Summary:

The following table summarizes Best Management Practices planned or implemented to address MCM 6 Goals:

Activity	Desired Goal	Target Audience	Measurable Goal
Annual Goals			
Increase and document municipal training program	Increase awareness of the potential impact that municipal operations have on stormwater	Public, Stormwater Management Officer, Municipal Employees	Document and track employee training
Document municipal operations, BMPs and SOPs that reduce the potential for stormwater impact	Reduction in potential chances for stormwater impact	Public, Stormwater Management Officer, Municipal Employees	Catalogue and track updates to BMPs and SOPs
Long-Term Goals			
Self-assess MCM 6 BMPs every three years	Improve efficiency of operations to minimize potential for stormwater impact	Public, Stormwater Management Officer, Municipal Employees	Track self-assessment

6.4: Reporting Requirements:

In order to assess the Measurable Goals and the effectiveness of the BMPs, the following items shall be tracked, measured and reported on the Town’s website and within the annual MS4 report, as required.

- Training program and opportunities for municipal employees.

- Track municipal operations associated with stormwater activities.
- Track self-assessments and changes to documentation.

STORMWATER MANAGEMENT PROCEDURE PLAN - STAFFING

The Town's Stormwater Management Plan responsibilities are shared by a wide range of personnel, boards and departments. These personnel, boards and departments are as follows: Stormwater Management Officer, Town Board, Planning Board, Zoning Board of Appeals, Town Engineer, Building Department, Utilities Department and Highway Department.

The Stormwater Management Officer is responsible for the oversight and implementation of the SWMP Plan and in promoting the Town's Stormwater policies.

The stormwater management responsibilities of the Town Board are to adopt local laws and authorize the actions of other municipal officials to manage stormwater.

The Planning Board is responsible for approving subdivisions and site plans, which includes the review of the Stormwater Pollution Prevention Plan as required by DEC regulations. The Planning Board has the authority to place conditions on approvals reflecting stormwater management goals.

The Zoning Board of Appeals is limited to interpreting the zoning law and issuing special use permits. The Zoning Board of Appeals has the authority to place conditions on approvals reflecting stormwater management goals.

When a Stormwater Pollution Prevention Plan is submitted as part of a subdivision or site plan application, the Stormwater Management Officer or TDE will review the Stormwater Pollution Prevention Plan in accordance with the New York State Stormwater Design Manual and the New York State Erosion and Sediment Control Manual.

The Building Department's staff will perform the required Construction Site Inspections during construction. The Building Inspector has the responsibility of issuing building and other permits and enforces the law. The Building Inspector, the Stormwater Management Officer, or a qualified designee will perform periodic inspections of construction sites and post construction stormwater management practices as needed.

The Utilities Department has the responsibility of installing and maintaining the water system and the sanitary sewer system and related facilities. The Utilities Department will address erosion problems related to the water and sanitary sewer system, and carries out emergency maintenance on these systems. The Town of North Greenbush employs 5 staff members as part of the Utilities Department.

The Highway Department has the responsibility of installing and maintaining storm drain systems and other stormwater management facilities, address erosion problems on roads and bridges, and carries out emergency maintenance. The Highway Department is also responsible for snow plowing and salting operations for Town roads and other properties. The Town of North Greenbush employs approximately 15 staff members in the Highway Department.

The municipal personnel and members of the various Town of North Greenbush's Boards and Departments involved with the stormwater management plan will attend yearly training. All training will be documented to ensure adequate training has been provided to each staff member based on their job responsibility. The Highway Department and Utilities Department personnel will have annual stormwater training meetings consisting of watching training videos in a group setting. After the video, everyone takes a written exam. Additional stormwater training will be provided with OSHA meetings and seminars when available. Personnel whom attend the seminars will train the personnel that did not attend the seminars. Additional training will be provided to the Highway Department and Utilities Department personnel including confined space and air quality monitor for confined space. The Stormwater

Management Officer and/or staff will attend monthly meetings and training sessions with the Rensselaer Counties MS4 Communities Coalition.

STORMWATER MANAGEMENT PROCEDURE PLAN - BUDGET

The Town's budget for the Stormwater Management Plan is included in the annual Highway Department Budget and the annual Utilities Department Budget. These budgets are located in Exhibit 31. These budgets include costs for such items as cleaning catch basins, sweeping streets and sidewalks, brush and leaf pick up, water system operation & maintenance, sanitary sewer operation and maintenance, weekly construction inspections, training, storm sewer television, inter-municipal agreement, and distribution of stormwater information.

STORMWATER MANAGEMENT PROCEDURE PLAN - EXHIBITS

- Exhibit 1: Public Presentation: Town of North Greenbush's Stormwater Management Program
- Exhibit 2: Pollutants of Concern
- Exhibit 3: Spill Response Procedures
- Exhibit 4: Current General Permit
- Exhibit 5: Waterbodies of Concern
- Exhibit 6: Snyders Lake Water Quality and Best Management Practices
- Exhibit 7: Geographic Areas of Concern
- Exhibit 8: Town of North Greenbush's Annual MS4 Report
- Exhibit 9: Developed Measurable Goals
- Exhibit 10: SWMP Review and Update Procedures
- Exhibit 11: Public Concerns Investigation Procedure
- Exhibit 12: Illicit Discharge Detection and Elimination Program
- Exhibit 13: Illicit Discharge Detection and Elimination Mapping
- Exhibit 14: Outfall Mapping
- Exhibit 15: Outfall Inspection and Monitoring Procedures
- Exhibit 16: Local Law No. 2 of the Year 2008 Illicit Discharges, Activities and Connections to the Town of North Greenbush's Municipal Separate Storm Sewer System
- Exhibit 17: Illicit Discharge Detection and Elimination Public Awareness Program
- Exhibit 18: Exempt Non-Stormwater Discharges
- Exhibit 19: Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control
- Exhibit 20: SWPPP Submission and Review Process

- Exhibit 21: SWPPP Pre-Construction Meeting and Training Verification
- Exhibit 22: SWPPP Inspection and Enforcement Policy
- Exhibit 23: SWPPP Post-Construction Inspection and Project Closure Policy
- Exhibit 24: Stormwater Permit Tracking Spreadsheet
- Exhibit 25: Post-Construction Stormwater Management Practices Inventory
- Exhibit 26: Post-Construction Stormwater Management Practices Inspection and Enforcement
- Exhibit 27: Pollution Prevention and Good Housekeeping for Municipal Operations
- Exhibit 28: Highway Department Vehicle and Garage Operation and Maintenance Procedures
- Exhibit 29: Highway Garage's Fuel and Petroleum Storage and Use Procedures
- Exhibit 30: Highway Garage's Salt Storage and Use Procedures
- Exhibit 31: SWMP Annual Budget

Exhibit 1

Public Presentation

Town of North Greenbush Stormwater Management Program

The Town has developed a Public Presentation program to discuss the principals of stormwater management and the regulatory and technical tools used to help minimize stormwater impacts. The presentation highlights the key points of the Stormwater Management Program (SWMP) Plan, the Stormwater Pollution Prevention Plan (SWPPP), and the roles that the Town and the public play in the management of stormwater impacts. The Town is planning to host an informative Stormwater Program public meeting in late April to introduce and discuss the various components of the Town’s Stormwater Management Policy.

The presentation will incorporate the following general items:

What is stormwater?

Stormwater is water from rain or melting snow that does not soak into the ground. It flows from rooftops, over paved areas, bare soil, sloped lawns and other low-permeability or impervious surfaces. As it flows, stormwater runoff collects and transports soil, animal waste, salt, pesticides, fertilizers, oil and grease, debris and other potential pollutants.

What's the problem?

Rain and snowmelt wash pollutants from streets, construction sites, private and public property, and other land into storm sewers and ditches. Eventually, the storm sewers and ditches discharge the polluted stormwater into streams and rivers with no treatment. This is known as stormwater pollution.

Polluted stormwater degrades lakes, rivers, wetlands and other waterways. Nutrients such as phosphorus and nitrogen can cause the overgrowth of algae resulting in oxygen depletion in waterways. Toxic substances from motor vehicles, industry, and careless application of pesticides and fertilizers threaten water quality and can kill fish and other aquatic life. Bacteria from animal wastes and improper connections to storm sewer systems can make lakes and waterways unsafe for wading, swimming and the consumption of fish. Eroded soil is also a pollutant. It not only clouds waterways and interferes with the habitat of aquatic species and plant life, but also eventually drops out of suspension and clogs or otherwise interferes with natural drainage pathways and filtration systems.

A sanitary sewer system and a storm sewer system are not the same:

Water that goes down a sink or other inside drain flows to either a wastewater treatment plant or to a septic system for treatment. Storm sewer flows are not treated. Water that flows down driveways, streets, and outside areas and into a storm sewer or ditch flows directly to the nearest creek, wildlife habitat, downstream recreational area, and/or drinking water supply.

There are many types of pollutants that find their way into storm drains:

A discussion on Pollutants of Concern (POCs), related to the following. Some common pollutants found in storm sewers and creeks include:

- Motor oil;
- Yard clippings and debris;
- Fertilizers and pesticides;
- Soapy car wash water and other cleaning products;
- Sediment eroded from construction projects and unstabilized soils;
- Litter; and
- Animal waste

It is important to remember that any type of surface water runoff, not just rainfall, can flow into the storm sewer and collect in the stormwater management system. For example, when you wash your car on the driveway, that water ends up in the system. That is why we need to be careful with what we put into the storm sewers as traces of all this material can end up in the stormwater system and our local waterways.

What is being done?

The Town of North Greenbush is working with the other Rensselaer County Municipal Separate Storm Sewer Systems (MS4) Communities in a forum for the regulated communities to share resources and work in partnership toward compliance with the United States Environmental Protection Agency (EPA) Phase II Stormwater requirements. The overall goal of the Communities is to utilize regional collaboration to identify existing resources and develop programs to reduce the negative impacts of stormwater pollution and ultimately improve the water quality on our streams and lakes.

The EPA Phase II Rule requires operators of small MS4s to develop and implement a stormwater management program that addresses six minimum controls. For each of these six control measures, measurable goals are to be selected and management practices identified and implemented to achieve those measurable goals.

The term "MS4 communities" include states, counties, cities, towns, villages, school districts and any other quasi-governmental agencies, such as special districts, that may have storm sewers that discharge into the environment. Storm sewers include ditches, enclosed storm sewer systems, and storm drains and catch basins that have exit pipes.

The EPA Phase II MS4 six minimum control measures, as defined in the SWMP, are listed below:

A discussion related to the SWMP will highlight the following topics:

1. Public Education & Outreach
2. Public Participation and Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Run-Off and Control
5. Post Construction Site Run-Off and Control
6. Pollution Prevention and Good Housekeeping for Municipal Operations

Public Measures

The Town has solicited, and received, active input from Town residents, particularly related to actions that townsfolk can take to minimize the impacts of stormwater events.

Literature

The Town SWMP, as posted on the North Greenbush website, will be the main focus of the public presentation. Also attached to this Exhibit are several other documents that will be considered as part of the overall public presentation.

The Homeowner's Guide to Stormwater

How to develop and implement a stormwater management plan for your property





Photo by Tetra Tech

Purpose of this Guide

If you are simply looking for a way to help protect or improve your watershed or you are doing a small home improvement project that creates new impervious area and you need to manage the stormwater that is generated*, this guide is for you. It will help you better understand:

- what is stormwater, why stormwater runoff can be a problem, and what you can do about it;
- how much stormwater runoff is generated by impervious areas on your property;
- how stormwater flows across and leaves your property; and
- how you can reduce the amount of stormwater runoff leaving your property.

This guide will help you create your own stormwater management plan and select simple stormwater solutions to be implemented on your property.

** Check with your local municipality to find out more about what permits may be required for any building projects.*

Disclaimer

The practices described in the guide are provided exclusively for general educational and informational purposes. The guide is intended to help property owners evaluate and assess current runoff pathways on their properties and identify practices to better manage stormwater. The guide outlines several practices to choose from that are fairly simple to plan and construct.

All efforts have been made to ensure the material in this guide is accurate and up to date. However, the Little Conestoga Partnership and its partner organizations cannot be held responsible for any circumstances resulting from its use, unavailability, or possible inaccuracy.

This guide is not intended to be a substitute for professional design and implementation services. This guide provides you with general information on an “as is” basis. You acknowledge that you assume the entire risk of loss in using this guide and the information provided herein, including without limitation any loss incurred by any end user. You further acknowledge that the management of stormwater is a complex and site specific issue and that the general information contained in this guide may not be sufficient to assess any and all particular site conditions. Any stormwater management practice should be installed with the consultation of an experienced professional who can address specific site conditions.

The Little Conestoga Partnership and its partner organizations make no representations and specifically disclaim all liabilities and warranties, express, implied, or statutory, regarding the accuracy, timeliness, or completeness for any particular purpose of any material contained on this site.

The information presented in this guide does not in any way replace or supersede any municipal, county, state, or federal requirements or regulations related to stormwater management. You should check with all appropriate regulatory authorities before relying upon this guide to plan or implement any and all stormwater management practices on your property.

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Section 1: Introduction

What is Stormwater Runoff?

Stormwater runoff is precipitation (rain or snowmelt) that flows across the land. Stormwater may infiltrate into soil, discharge directly into streams, water bodies, or drain inlets, or evaporate back into the atmosphere.

In the natural environment, most precipitation is absorbed by trees and plants or permeates into the ground, which results in stable stream flows and good water quality.



Photo by Matt Royer, Penn State

Things are different in the built environment. Rain that falls on a roof, driveway, patio or lawn runs off the surface more rapidly, picking up pollutants as it goes. This stormwater runoff flows into streams or storm drains that discharge into waterways like the Little Conestoga Creek, the Susquehanna River and eventually the Chesapeake Bay.



Photo by Matt Kofroth, LCCD

Why Can Stormwater Runoff Be a Problem?

Poorly managed stormwater runoff can cause a host of problems. These include:

- ◆ **Flooding.** As stormwater runs off roofs, driveways and lawns, large volumes quickly reach streams, causing them to rise quickly and flood, instead of a natural slow and steady water rise. When more impervious surfaces exist, flooding occurs more rapidly and can be more severe, resulting in damage to property and people.
- ◆ **Pollution.** Stormwater running over roofs, driveways, roads and lawns will pick up pollutants such as oil, fertilizers, pesticides, dirt/sediment, trash, and animal waste. These pollutants “hitch a ride” with the stormwater and flow untreated into local streams, polluting our waters.
- ◆ **Stream Bank Erosion.** When stormwater flows into streams at unnaturally high volumes and speeds, the power of these flows can cause severe stream bank erosion. Eroding banks can eat away at streamside property, create dangerous situations, and damage natural habitat for fish and other aquatic life. This erosion is another source of sediment pollution in streams.



Photo by Kristen Kyler, Penn State



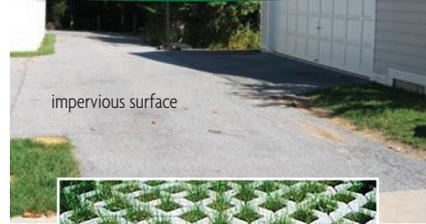
Photo by Matt Kofroth, LCCD

💧 **Threats to Human Health.** Stormwater runoff can carry many toxic pollutants, such as toxic metals, organic compounds, bacteria, and viruses. Polluted stormwater can contaminate drinking water supplies and hamper recreational opportunities as well as threaten fish and other aquatic life.

What Can I Do to Help?

As a homeowner, you can help avoid the problems associated with stormwater runoff by:

- 💧 reducing impervious areas so that the rain soaks into the ground
- 💧 planting native trees and plants which help infiltrate stormwater and increase evaporation and transpiration
- 💧 following the lawn care practices described in this guide
- 💧 managing stormwater on-site with rain gardens, rain barrels and similar practices
- 💧 doing many small things, you have a big impact on improving stormwater management



Photos by Matt Kofroth, LCCD



Managing stormwater on your property will not only help protect local streams, but will also help clean up downstream waterways including the Chesapeake Bay.

“As of 2011, 17.5 million people were estimated to live in the Bay watershed, up from 17.4 million in 2010. Experts predict the watershed’s population will increase to more than 20 million by 2030.” (*Chesapeake Bay Program*)



Section 2: Assessing Stormwater on Your Property

In order to better manage stormwater on your property you should first understand how stormwater is generated and flows on your property. Follow these simple steps to figure out where stormwater is generated, how it flows, and approximately how much stormwater comes from your property.

1. Walk your property and map your boundaries and basic features.

Step 1: Draw your property boundaries.

Draw the boundaries of your lot. If you are not sure of your boundaries, you may be able to look this up on your property tax assessment, deed to your house, or at your county's tax office.



Map created by Kara Kalupson, LCCD

Step 2: Draw buildings and other features of your property.

Draw and label the buildings and other features of your property. These include:



Map created by Kara Kalupson, LCCD

- ◆ **Impervious areas.** These are hard surfaces on your property that prevent stormwater from soaking into the ground. They include buildings, driveways, parking areas, walkways, decks, patios, or other hard surfaces.
- ◆ **Lawn and landscaped areas.** These include any areas with grass or landscaping that you regularly maintain.
- ◆ **Natural vegetation.** These are areas of woods, meadow, or other naturally vegetated areas that are allowed to grow natural on your property.
- ◆ **Water features.** These could be streams, wetlands, ponds or swimming pools.

You can determine the approximate size of each area by using a tape measure and calculating the square footage of each. Depending on the overall size of your property, you may want to calculate these areas in square feet or convert to acres (1 acre = 43,560 square feet). If your property has no natural vegetation, such as woods or meadows, or water features on it, you can simply subtract the impervious areas from your total lot size to get your total lawn and landscaped area.



Photo by Matt Royer, Penn State

2. Assess and map your stormwater flow.

The next step is to show how and where runoff flows on your property and identify any problems it may be causing. Common stormwater problems may include large puddles (“ponding”), damp basements, soil erosion, and collapsing stream banks. The ideal time to assess stormwater flow would be during or immediately after a rain storm. Look for and map the following:

◆ **Roof downspouts.** Indicate the location of roof downspouts and the direction stormwater flows from the downspouts.

◆ **Stormwater flow paths.** Using arrows, show the direction of stormwater flow off of impervious surfaces. If you have any areas where stormwater collects, such as drainage swales or ditches, show this and label them as such.

◆ **Areas of ponding.** Indicate locations of standing water or ponding on the map.

◆ **Gullies or ditches from soil erosion.** Indicate any areas of soil erosion which have resulted in gullies or ditches. This may appear within existing drainage swales or channels, and would be good to note on your assessment.



Map created by Kara Kalupson, LCCD



If you have multiple downspouts, drainage channels, ponding areas etc., organize your map and assessment plan by numbering them.

Photo by Matt Kofroth, LCCD





3. Estimate how much stormwater is generated on your property.

The amount of stormwater runoff generated from your property depends on how long and how hard it rains, the slope of your property, the type and quality of the soils, the amount of impervious surface on your property, and other factors. Nevertheless, there is a simple calculation you can use to estimate how much stormwater runoff your property generates during a typical rainstorm.

The majority of annual rainfall in south-central Pennsylvania comes in the form of small storms of one inch or less. These small storms carry most of the pollutants that impact water quality, and thus the stormwater generated by your property for the one inch storm is a good measure of typical stormwater runoff. Use the following chart to determine how much stormwater is generated by the impervious area on your property:



Photo by Margaret Kyler

Square Feet of Impervious Area	Gallons of Runoff to be Managed
500 or less	less than 312
501 – 1,000	312 – 624
1,001 – 2,000	624 – 1,246
2,001 – 3,000	1,246 – 1,869
3,001 – 4,000	1,869 – 2,492
4,001 – 5,000	2,492 – 3,115
5,001 – 10,000	3,115 – 6,231
10,001 – 20,000	6,231 – 12,462
20,001 – 43,000	12,462 – 26,793

The above numbers were calculated using the following formula:

(Total square feet of impervious area) x 0.0833 x 7.48 = _____ gallons of runoff

Use this formula if you want a more accurate calculation of the runoff generated from your impervious area.

0.0833 is to covert feet to inches • 7.48 = number of gallons per cubic foot

Section 3: Developing Your Stormwater Management Plan

Now that you know what areas of your property generate stormwater when it rains, how the runoff flows, and what areas generate the most amount of runoff, you can start thinking about adding stormwater management practices to your property to better manage runoff.

1. Types of stormwater best management practices.

Many management practices exist for handling stormwater runoff. This guide suggests six of the simpler, easier to implement practices. Each practice is introduced briefly in this section so you can consider which ones are right for you.

<p>Rain Garden A depressed garden that uses mulch, soil, and deep-rooted native plants to capture, absorb, and infiltrate stormwater.</p> <p style="text-align: right;"><small>Photo by Matt Kofroth, LCCD</small></p>		
<p>Benefits</p> <ul style="list-style-type: none"> ◆ Manages stormwater and filters pollutants ◆ Wildlife habitat ◆ Little maintenance ◆ Adds beauty 	<p>Negatives</p> <ul style="list-style-type: none"> ◆ Plants can take 2-3 years to establish ◆ More maintenance required in first few years 	
		<p>Cost \$\$</p>
<p>Maintenance</p> <ul style="list-style-type: none"> ◆ Low once plants established ◆ Weeding and watering in first two years. ◆ Some thinning in later years 	<p>Aesthetic appeal</p> <ul style="list-style-type: none"> ◆ Ranges from medium to high ◆ Can customize based on plant selection. 	<p>Implementation Considerations</p> <ul style="list-style-type: none"> ◆ Construct downslope of runoff to be captured ◆ Plant in spring or fall ◆ Locate at least 10 feet from building foundations
<p>Riparian Buffer Planting native trees and shrubs along streams and wetlands to restore the streamside area to forested conditions. These “riparian buffers” filter runoff and have numerous water quality benefits.</p> <p style="text-align: right;"><small>Photo by Matt Kofroth, LCCD</small></p>		
<p>Benefits</p> <ul style="list-style-type: none"> ◆ Increases infiltration and groundwater recharge ◆ Improves water quality ◆ Controls erosion & sedimentation ◆ Provides wildlife habitat 	<p>Negatives</p> <ul style="list-style-type: none"> ◆ Not as effective on steep slopes ◆ More difficult to implement than some other practices 	
		<p>Cost \$</p>
<p>Maintenance</p> <ul style="list-style-type: none"> ◆ Low once native plants are established ◆ Weeding and watering in first two years ◆ Some plant thinning in later years ◆ Regularly remove debris and excessive sediment accumulation 	<p>Aesthetic appeal</p> <ul style="list-style-type: none"> ◆ Ranges from medium to high ◆ Higher aesthetic appeal than conventional stormwater conveyances 	<p>Implementation Considerations</p> <ul style="list-style-type: none"> ◆ Plant in spring or fall ◆ Locate at least 10 feet from building foundations

Tree Planting

Planting native trees and shrubs to restore a portion of your property to forested conditions.

Photo by Matt Royer, Penn State



Benefits

- Increases infiltration and evapotranspiration of stormwater
- Filters pollutants
- Requires little maintenance
- Provides wildlife habitat
- Large canopy of native trees maximizes benefits

Negatives

- Takes many years before trees grow to provide maximum benefit
- Regular maintenance is required where invasive plant species exist
- Must guard against deer browsing and vole damage

Cost

\$/\$\$

- Varies, depending on species, size, and type of tree planted

Maintenance

- Maintain tree tube/stakes or cages
- Spray and mow between trees at least twice a year during first 4 to 5 years

Aesthetic appeal

- High aesthetic appeal, as trees add interest, structure, color, and wildlife to property

Implementation Considerations

- Plant in spring or fall
- Watering may be necessary after planting during dry weather (25 gallons/week)



“A Wharton School of Business study found that new tree plantings in a Philadelphia neighborhood increased surrounding property values by approximately 10%.”

(Wachter 2004)

Native Meadow

An area planted with native grasses and wildflowers and maintained as a natural area. “No mow” areas can also develop into meadow areas.

Photo by Dick Brown



Benefits

- Increases infiltration and evapotranspiration of stormwater
- Filters pollutants
- Requires little maintenance
- Provides wildlife habitat

Negatives

- Site preparation (including turf grass removal) is required before planting
- Meadows may conflict with local weed ordinances

Cost

\$

- Native seed mixes vary depending on type of species and amount of variety desired

Maintenance

- Mow twice a year for first two years
- Mow annually
- Control invasive plant species

Aesthetic appeal

- High aesthetic appeal, as tall grasses and wildflowers add interest, structure, color and wildlife to property

Implementation Considerations

- Plant in spring
- Monitor and control invasive species

Appendix A: Stormwater Management Plan Template

You can use this template to create your stormwater management plan.

Map

First, use the grid paper provided to hand draw your stormwater management plan map. Or, follow the tutorial provided in **Appendix B** to create a computer generated aerial map.

If you hand draw your map, it is suggested you use one ink color to draw existing conditions and a different color to draw your proposed stormwater management practices.

Plan Details

Second, fill in the template to create the details of your plan. For both existing conditions and proposed stormwater management practices, be sure to label all features on your map with numbers that correspond to the plan template.

Stormwater Management Plan

Property Owners Name: _____

Property Address: _____

Municipality: _____ County: _____

Watershed: _____ (example: Little Conestoga)

Name of stream into which stormwater flows: _____ (example: Swarr Run)

EXISTING CONDITIONS

IMPERVIOUS AREAS		
Buildings		
Number	Description (house, shed, etc)	Square Feet
Driveways and Walkways		
Number	Description (driveway, back walkway, front walkway, etc)	Square Feet
Other Hard Surfaces		
Number	Description (patio, deck, etc)	Square Feet
Total Impervious Area:		

LAWN AND LANDSCAPED AREAS

Number	Description (front yard, back yard, flowerbed, etc)	Square Feet
Total Lawn and Landscape Area:		

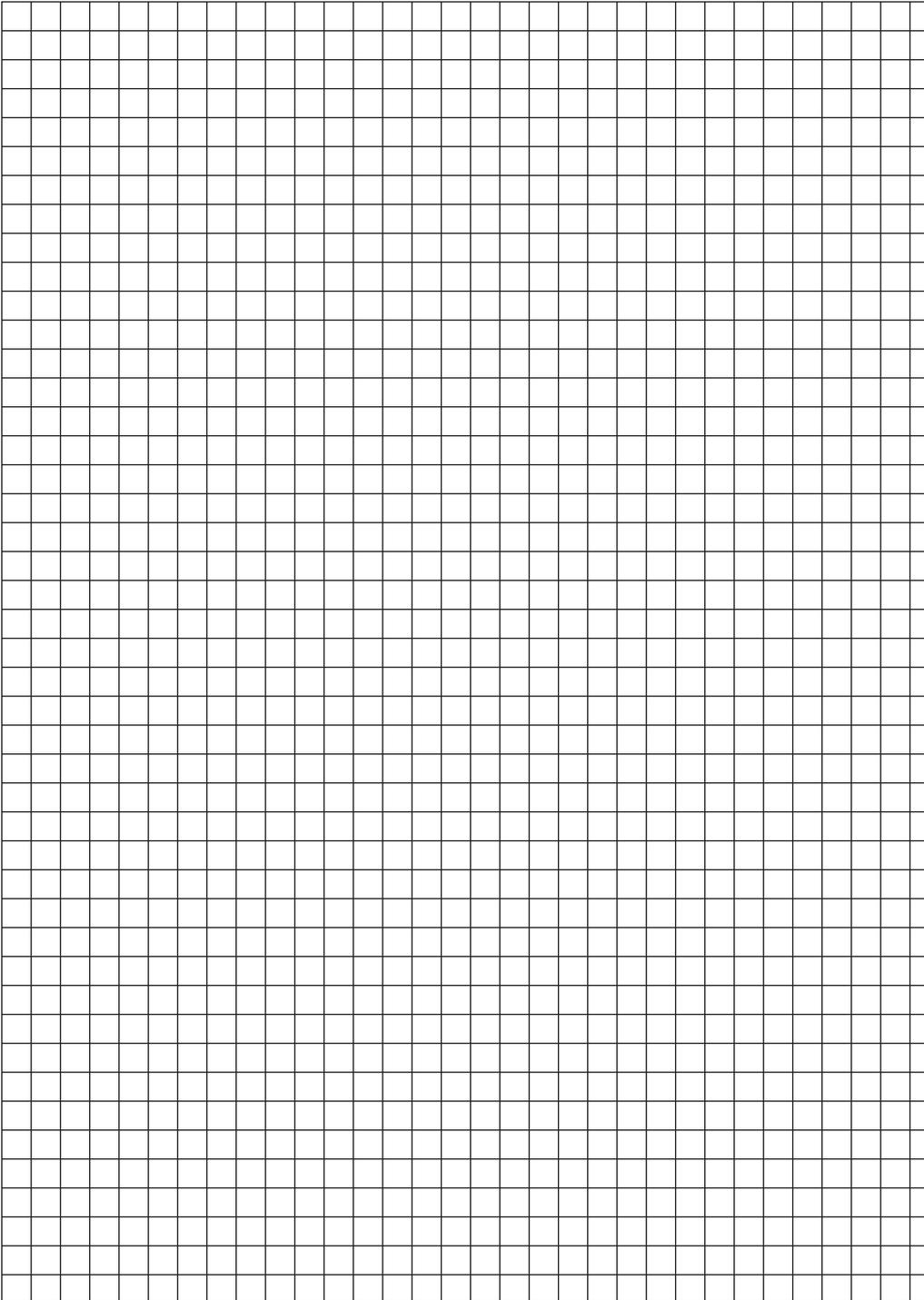
NATURAL AREAS

Woods		
Number	Description (back woodlot, side woods, etc)	Square Feet
Meadow		
Number	Description (back meadow, front meadow, etc)	Square Feet
Total Natural Area:		

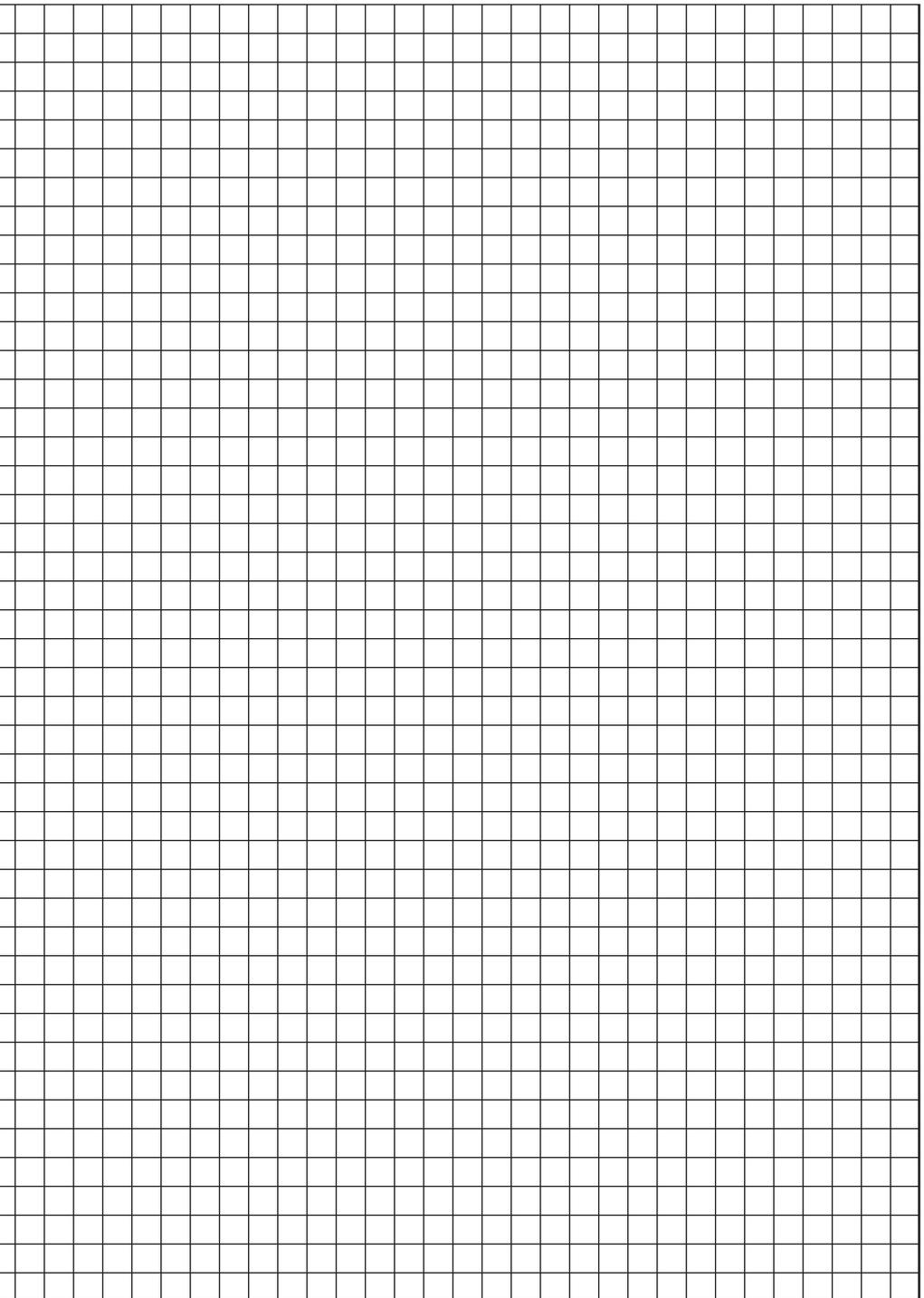
Note any water features (streams, wetlands, ponds, etc) on your property:

Total Stormwater Generated in a 1 inch rainstorm:
 (Total Impervious Areas x 0.0833 x 7.48)

_____ ft² x 0.0833 ft x 7.48gal./ft³ = _____ gallons



gement Plan Map



Proposed Stormwater Best Management Practices

Rain Garden		
Number	Description (front yard, back yard, etc)	Square Feet
Riparian Buffer		
Number	Description (tributary, main stem of creek, wetland, etc)	Linear Feet
Tree Planting		
Number	Description (backyard woods, side woods, etc)	Square Feet
Native Meadow		
Number	Description (side yard meadow, back yard meadow, etc)	Square Feet
Pervious Pavers		
Number	Description (front walkway; back patio etc)	Square Feet
Rain Barrel		
Number	Description (side house barrel, shed barrel, etc)	Gallons

Appendix B: Computer Mapping Tutorial

1. Open Internet Explorer.

Go to Google maps (www.google.com/maps) or Bing maps (www.bing.com/maps) to access an aerial map of your property.

2. Type in your property address.

Use the zoom functions to zoom in as close as you can to your property, making sure your entire lot is shown on the map. Make sure the “Satellite” or “Aerial” function is turned on so that the map is shown in aerial photography format.

3. Press “Print Screen”, Paste.

In the upper right corner of your keyboard press “Print Screen.” Paste the screen shot in the program of your choice to crop and edit. We recommend Power Point, Microsoft Word or Paint.

4. Use drawing tools to add your different elements.

Using the “shapes” or other drawing tools available you can add your areas affected by stormwater and your new BMPs. The arrows and freeform tools are particularly useful. Be sure to use different colors for different elements of your map. Text boxes can be used to add labels or a legend.

5. Save and print your map.

When you are done, you can save your map as a .pdf or print it to go with your written stormwater management plan.

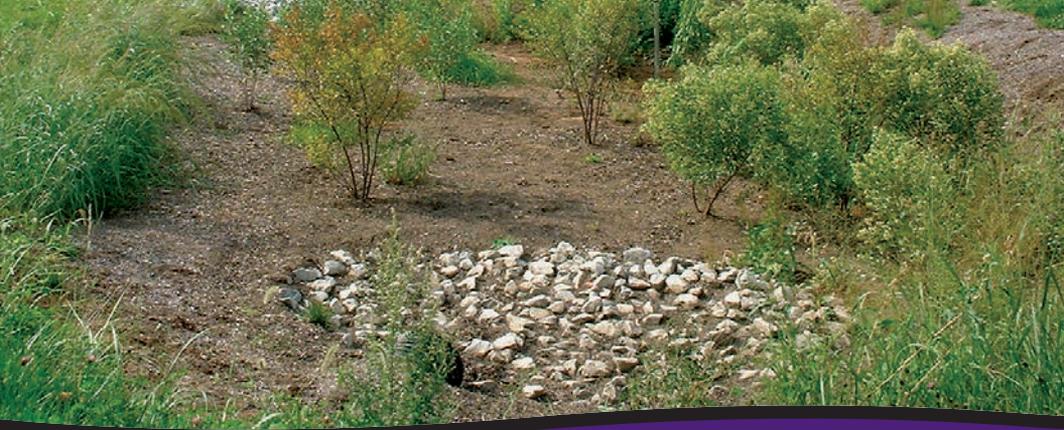
<p>Pervious Pavers Impervious building materials, such as stone, concrete or brick, laid with space in between to allow for pervious areas (gravel, sand or vegetation) in driveways, parking areas, or walkways.</p> <p style="text-align: right;">Photo by Matt Kofroth, LCCD</p>		
<p>Benefits</p> <ul style="list-style-type: none"> Increases infiltration and groundwater recharge Reduces volume and rate of runoff 	<p>Negatives</p> <ul style="list-style-type: none"> More labor intensive to install than other practices Nonconventional option to pavement 	<p>Cost \$\$</p> <ul style="list-style-type: none"> Can save by installing permeable pavers May need to excavate and install sub base, increasing costs
<p>Maintenance</p> <ul style="list-style-type: none"> Moderate to high maintenance Grass between pavers may have to be mowed Inspect for signs of clogging Pressure wash and replace pea stone as needed 	<p>Aesthetic appeal</p> <ul style="list-style-type: none"> Ranges from low to medium Artistic designs with layout can increase aesthetic appeal 	<p>Implementation Considerations</p> <ul style="list-style-type: none"> Need to install permeable sub base Locate at least 10 feet from building foundations

Rain Barrel/Cistern
 A barrel that captures rainwater from a roof and stores it for later use, such as watering plants or gardens. A cistern is a larger container that does the same thing.

Photo by Fritz Schroeder, Live Green



<p>Benefits</p> <ul style="list-style-type: none"> Conserves water Captures and reuses stormwater 	<p>Negatives</p> <ul style="list-style-type: none"> Minimal volume captured Poor construction or maintenance can result in mosquitoes 	<p>Cost \$</p> <ul style="list-style-type: none"> Very minimal cost as DIY project Can save dollars because of reduced potable water usage
<p>Maintenance</p> <ul style="list-style-type: none"> Clean screen/filter regularly Clean gutters twice annually Monitor during severe storms to avoid overflow Empty before winter months 	<p>Aesthetic appeal</p> <ul style="list-style-type: none"> Ranges from low to medium depending on type of barrel used 	<p>Implementation Considerations</p> <ul style="list-style-type: none"> Place on level surface Full rain barrel weighs 400 lbs



2. Factors to consider when choosing stormwater best management practices for your property.

Here are some considerations that might help you decide which practices you would like to install on your property.

- ◆ If you would like to enhance your landscaping with flowers and other attractive plants consider a rain garden or a native meadow.
- ◆ If you want to reduce the amount of time it takes to mow the lawn, a rain garden or native meadow would help accomplish this goal.



Photo by Dick Brown



Photo by Matt Kofroth, LCCD

- ◆ If you would like to see more butterflies, a rain garden or native meadow can provide excellent butterfly habitat.
- ◆ If you have outdoor water needs (water for a vegetable garden, to water your lawn, or to wash your car) consider a rain barrel.
- ◆ If you don't have very much yard to work with, a rain barrel is probably the best choice.
- ◆ If your driveway needs repaved, consider using pervious pavers instead of traditional pavement.
- ◆ If you would like to give your patio a new look, consider pervious pavers.

Photo by Andrew Gavin, SRBC 1

- ◆ If you would like to restore forested conditions on a portion of your property, consider tree planting (or forested riparian buffer if the area to be reforested is along a stream).
- ◆ If a stream is running through your property, installing a riparian buffer would be very beneficial.
- ◆ If you want to cut down on air conditioning costs during the summer, consider planting some trees on your property.



3. Choose where to locate the stormwater best management practices on your property.

Now that you know about your property and the type of practices you would like to install, it's time to choose the right location for the practices. Some considerations in your planning are:

◆ **Ponding Water.** Many stormwater practices encourage water to infiltrate into the soil (such as rain gardens and pervious pavers). Where water ponds on your property, water is unable to infiltrate. Areas that are often saturated are not appropriate places to put these practices.

(Note- if you have an on-lot sanitary septic disposal system and an area is permanently wet near this system, the septic system may be failing. The disposal system should be evaluated and fixed before any other practices are installed.)

◆ **Depth to bedrock.** You do not want to construct infiltration practices where bedrock is visible or is close to the surface.

◆ **Proximity to foundations.** You should also avoid constructing infiltration practices within 10 feet of building foundations.

◆ **Location of underground utilities.** Do not construct infiltration practices near septic systems or drinking water wells. Also avoid any utilities like electric, cable, water, sewer, and gas lines. (make sure to use the PAONE-CALL system to locate underground utilities)

◆ **Slope.** Depending on the practice, a steeper slope may prohibit siting, or it may be something that needs to be taken into account during the design stage. Consult the chart on the next page for guidance.

◆ **Soil percolation.** Since rain gardens and pervious pavers are designed to infiltrate stormwater into the ground, the soil in the location of the rain garden or pervious pavers must be able to drain. When considering these practices, you should conduct a simple percolation test where you would like to locate them:

- Dig a 1 foot deep hole and fill with water.
- Allow the water to moisten soil and drain completely. If water is still in the hole after 24 hours, choose a different location.
- Fill the hole with water a second time and place a ruler in the hole. Note the water level and time.
- After 15 minutes, re-measure the water level. Multiply the change in water level by 4 to get the number of inches of infiltration per hour.



Photos by Kristen Kyler, Penn State



Use this summary chart to help you select one or more stormwater practices that are right for your property.

	Rain Garden	Riparian Buffer	Tree Planting	Native Meadow	Pervious Pavers	Rain Barrel/Cistern
Space Required	Minimum Size: 50 – 200 ft ² surface area 5 – 10 ft wide 10 – 20 ft long 3 – 8 inches deep	The wider the better for water quality benefits. Lot size and configuration will impact buffer width	Consider space needed for canopy spread	Not a factor	As needed to accommodate walkway, patio, or driveway	Not a factor
Slopes	Not usually a limitation, but a design consideration. Locate down slope of building foundations	Not usually a limitation, but a design consideration	Not usually a limitation, but a design consideration	5% or less	Not a factor	Not a factor
Depth to Water Table	1 – 4 ft clearance	Not a factor if correct species are planted			1 – 4 ft clearance	Not a factor
Depth to Bedrock	1 – 4 ft clearance	1 – 4 ft clearance	1 – 4 ft clearance	Not a factor	1 – 4 ft clearance	Not a factor
Building Foundations	Minimum 10 ft down slope from building foundations				Not a factor	Not a factor
Maintenance All practices should be inspected seasonally and after major storm events.	Low: Weeding and watering in first 2 years. Some thinning in later years.	Low to Moderate: Maintain tree tubes or cages. Spray and mow between trees for first 4-5 years. Control invasive plants. Water as needed.	Low to Moderate: Maintain tree tubes or cages. Spray and mow between trees for first 4-5 years. Control invasive plants. Water as needed.	Low to Moderate: Mow twice annually for first two years. Control invasive plants.	Moderate to High: Grass between pavers may have to be mowed. Inspect for signs of clogging. Pressure wash and replace pea stone as needed.	Low: Clean screen/filter regularly. Clean gutters twice annually. Monitor during severe storms for overflow. Empty before winter months.

Chart adapted from the New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions. NH Department of Environmental Services (March 2011, revised February 2012).

Please remember to call PA ONE CALL before digging underground so you know where your underground utilities are located (ie electrical, sanitary sewer, water, etc.).

4. List and map your chosen stormwater best management practices.

Now that you've chosen stormwater management practices for your property, list them on the stormwater management plan template provided in Appendix A. Draw them on your property map. Again, you can either hand draw them on the graph paper provided in Appendix A, or continue to follow the Computer Mapping Tutorial in Appendix B to map your chosen stormwater practices on your computer generated property map.



Map created by Kara Kalupson, LCCD

Section 4: Implementing Your Stormwater Plan

Congratulations! Your stormwater management plan is complete! You have taken an important step in managing stormwater on your property to help clean up your local stream and the Chesapeake Bay.

Now you are ready to start implementing your plan. If you are a do-it-yourselfer, there are several online resources that provide detailed design and implementation guidance for the six practices discussed in this guide. *Note: Please refer to the disclaimer at the beginning of this guide.*

The Chesapeake Stormwater Network (www.chesapeakestormwater.net) is in the process of developing a homeowner rain garden guide that will provide excellent step-by-step guidance on designing, constructing and maintaining rain gardens and other practices. Refer to the Chesapeake Stormwater Network's website often for updates as this guide is finalized.

In the meantime, here are some other online guides you can reference:

RAIN GARDENS

Rain Gardens: A How-To Manual for Homeowners (University of Wisconsin Extension)

<http://learningstore.uwex.edu/assets/pdfs/GWQ037.pdf>

Rain Gardens in Connecticut: A Design Guide for Homeowners (UConn Cooperative Extension System)

http://nemo.uconn.edu/publications/rain_garden_broch.pdf

Rain Garden Templates for the Chesapeake Bay Watershed (Low Impact Development Center)

http://www.lowimpactdevelopment.org/raingarden_design/templates.htm

RIPARIAN BUFFERS

Riparian Forest Buffer Guidance (PA Department of Environmental Protection)

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82308/394-5600-001.pdf>

TREE PLANTING

Planting and After Care of Community Trees (Penn State Extension)

<http://pubs.cas.psu.edu/freepubs/pdfs/uh143.pdf>

PATrees.org: The Free Resource Guide

<http://www.patrees.org>

NATIVE MEADOWS

Meadows and Prairies: Wildlife-Friendly Alternatives to Lawn (Penn State Extension)

<http://pubs.cas.psu.edu/FreePubs/pdfs/uh117.pdf>

PERVIOUS PAVERS

New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself

Stormwater Solutions: Pervious Walkways & Patios (NH Department of Environmental Sciences)

<http://des.nh.gov/organization/divisions/water/stormwater/documents/perv-walkw-patios-fs.pdf>

RAIN BARRELS AND CISTERNS

Rain Barrel Installation Instructions (Rutgers Cooperative Extension)

http://water.rutgers.edu/Stormwater_Management/rainbarrelbrochure.pdf

Build Your Own Rain Barrel (Chesapeake Bay Foundation) <http://www.cbf.org/Document.Doc?id=30>

Rainwater Harvesting: Guidance for Homeowners (North Carolina Cooperative Extension)

<http://www.ces.ncsu.edu/depts/agecon/WECO/documents/WaterHarvestHome2008.pdf>

Pervious Paver



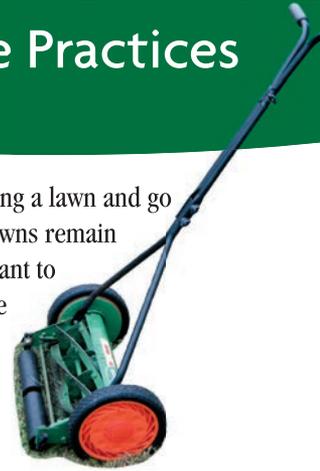
If installing these stormwater practices is not something you want to tackle, you can take your plan to a landscape professional with experience in designing and implementing these types of stormwater practices. You may want to do some of the work yourself and enlist the help of a professional to do the other part. The choice is up to you.

Please note that this guide focuses on six practices that are fairly simple to plan and construct. There are many other, more complex stormwater best management practices that may be applicable to your property and that you may want to consider. These include bioswales, underground cisterns, drywells, pervious pavement, infiltration trenches and many more. If you are interested in seeing if any of these types of practices are a good fit for your property, you should consult an experienced professional to plan, design and implement them.

Section 5: Healthy Lawn Care Practices

The practices described in this guide are alternatives to maintaining a lawn and go a long way to protecting our streams and the Chesapeake Bay. Yet lawns remain a significant component of the residential landscape, and are important to homeowners for many uses. By properly managing this resource, we can significantly improve water quality in the Bay.

A recent report by the Chesapeake Bay Program of EPA compiled much of the research about lawns and their contribution to pollution in stormwater runoff. Their overall conclusion is that maintaining a dense, vegetative cover of turf grass reduces runoff, prevents erosion and retains nutrients in the turf grass (see “Expert Panel Report”). <http://chesapeakestormwater.net/wp-content/plugins/download-monitor/download.php?id=279>.



In fact, recent estimates indicate that lawns and turf grass are now the largest “crop” in the Chesapeake Bay watershed, covering more than 3.8 million acres and eclipsing pasture, hay/alfalfa and row crops like corn, soybean and wheat. See Chesapeake Stormwater Network, [Technical Bulletin No. 8: The Clipping Point](#).



Here are the EPA Expert Panel's recommendations for growing and maintaining a Bay-friendly lawn:

Lawn Care Practice 1. Consult with the local extension service office, certified plan writer or applicator to get technical assistance to develop an effective urban nutrient management plan for the property, based on a soil test analysis.

The precise lawn care prescription should be based on site-specific recommendations that take into account soil properties, the type of grass species, the age of the lawn, and other factors. Professional expertise is essential to develop an effective plan. Look for professionals who are Pennsylvania Certified Horticulturists or Landscape Industry Certified.

Lawn Care Practice 2. Maintain a dense vegetative cover of turf grass to reduce runoff, prevent erosion, and retain nutrients.

Dense vegetative cover helps to reduce surface runoff which can be responsible for significant pollution from the lawn, regardless of whether it is fertilized or not.

If your lawn does not have a dense turf grass cover, identify the factors responsible for the poor turf cover, and implement practices to improve it (e.g., tilling, soil amendments, fertilization or conservation landscaping).

Lawn Care Practice 3. Per the plan developed by your local extension agent or your lawn care professional, follow one of three fertilizer application strategies: (1) choose not to fertilize; (2) reduce rate and monitor; or (3) apply less than a pound of nitrogen per 1000 square feet per each individual application.

In order to reduce nutrient runoff from fertilizing your lawn, employ one of three fertilizer application strategies, depending upon the condition of your lawn and your needs and preferences.

First, elect not to fertilize at all. Some lawns, due to their age or natural soil fertility may be able to maintain a healthy, dense cover without additional fertilization. (However, if your lawn is thin, is weed infested or has bare spots, you should consider fertilizing to restore a thick turf grass cover, using one of the other two strategies.)



Second, take a “reduced rate and monitor” approach. For this approach, follow the nitrogen application rates on the fertilizer bag label and reduce them by one-third to a half, and monitor the results. If lawn quality starts to fall below acceptable levels, re-apply at the reduced rates.

Third, fertilize as the Penn State Extension recommended rate (3.0 to 3.5 pounds per 1,000 square feet of nitrogen per season), but split into 3 or 4 small doses during the growing season (for example, early spring, late spring, late summer and mid-fall). This will get you to an accepted application rate of less than a pound of nitrogen per 1000 square feet for each individual application.

Most bagged fertilizers in Pennsylvania have already removed phosphorus from their products, except for “starter fertilizers” used to establish grass seed in new lawns. If your soil tests show a phosphorus deficiency, ask your lawn care professional for recommendations on how to provide the phosphorus your lawn needs.

Lawn Care Practice 4. Retain clippings and mulched leaves on the lawn and keep them out of streets and storm drains.

Use a mulching mower to return grass clippings and leaves to your lawn. Lawn clippings are an important nutrient source for lawns, as well as an important source of organic matter which enhances stormwater infiltration, soil health and water retention. Nitrogen fertilization can be reduced without decreasing turf grass quality when clippings are left to decompose and return to the lawn.

Lawn clippings are high in nutrients and should be treated as if they were a fertilizer. You should keep lawn clippings and leaves on your lawn, and out of the gutter, street or storm drain system, regardless of whether you fertilize or not. In addition, the amount of nutrients supplied by lawn clippings and mulched leaves should be accounted for when assessing fertilizer needs.

Lawn Care Practice 5. Do not apply fertilizers before spring green up or after the grass becomes dormant.

The risk of pollution by leaching or surface runoff is greatest during the seasons of the year when the grass is dormant. Avoid applying fertilizer in the late fall or winter. In spring, wait until the grass begins to green.

Lawn Care Practice 6. Maximize use of slow release N fertilizer.

Less nutrient loss occurs when slow release fertilizer products are used during the growing season, compared to water soluble formulations. Slow release fertilizer is typically shown on fertilizer products as water insoluble nitrogen (WIN), and can range from 20 to 50% of the total nitrogen product. You can shop for the fertilizer product with the greatest percentage of WIN. Avoid using in late fall as they may release nitrogen when the grass is dormant or frozen.

Lawn Care Practice 7. Set Mower height at 3 inches or taller.

Maintaining taller grass produces a deeper and more extensive root system, increasing nutrient uptake and reducing runoff. The deeper roots also capture moisture during times of drought, suppress weeds and increase turf density.

Lawn Care Practice 8. Immediately sweep off any fertilizer that lands on a paved surface.

Rotary spreaders are the most common method to apply fertilizers and can broadcast fertilizer granules near the edge of the lawn, street or driveway, where they can be subsequently washed off in a rain storm. Sweep up wayward granules before they have a chance to get into gutters and storm sewers. If you use a rotary spreader, purchase one with a deflector shield to prevent spraying fertilizer on the street, driveway or sidewalks.

Lawn Care Practice 9. Do not apply fertilizer within 15 to 20 feet of a stream, pond or other water body and consider managing this zone as a perennial planting, meadow, grass buffer or forest buffer.

The risk of runoff is greatest from lawn areas adjacent to water features such as streams, shorelines, sinkholes and drainage ditches. Consider establishing a riparian buffer of shrubs, trees or perennials along streams and other water courses.

Lawn Care Practice 10. Employ stormwater practices to increase soil porosity and infiltration capability, especially along portions of the lawn that are used to convey or treat stormwater runoff.

A well maintained lawn, with a dense healthy cover of turf grass significantly slows and absorbs stormwater runoff. However, you should consider installing stormwater best management practices where runoff is causing problems. Rain gardens, rain barrels, and bioswales help lawns infiltrate excess stormwater.



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NFWF

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Sciences



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DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

- Lancaster County Planning Commission
- Lancaster County Clean Water Consortium

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Rensselaer County has over 500 lakes and large ponds which have provided recreational and residential opportunities for many decades. The lakes were popular places for vacation cabins, which have now turned into full time residences.

Due to the impacts of year-round residences and use, water quality in the lakes has decreased in many places. Unlike rivers and creeks, lakes have a slow water flow through them that does not allow the relatively rapid flushing of pollutants and nutrients, creating long term issues that do not have quick fixes.

To prevent these issues or to not add to them, there are many things that lakeside residents can do to maintain and improve lake water quality. It is our attempt to provide guidance to assist residents to keep their lakes clean and healthy.

To get additional information:

Contacts:

NYS DEC REGION 4 HOTLINE: 1-800-847-7332

DEC Environmental Quality: 357-2045

DEC Website: www.dec.ny.gov

Rensselaer Co. Environmental Health Section: 270-2674

Rensselaer Co. Cooperative Extension: 272-4210

Rensselaer County Soil and Water Conservation

District/NRCS: 271-1740

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Castleton-on-Hudson MS4 Contact: Norman Wiley, 732-2211

East Greenbush MS4 Contact: Ron Stark, 477-6225

North Greenbush MS4 Contact: Mike Miner, 283-3921

Poestenkill MS4 Contact: Bob Brunet, 283-5100

Rensselaer MS4 Contact: Mark Hendricks, 465-1693

Sand Lake MS4 Contact: Mike Wager, 674-2026 x16

Schaghticoke MS4 Contact: Jean Carlson, 753-6915

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LAKESIDE LIVING

Keeping the Waters Clean

TIPS ON MAINTAINING WATER
QUALITY IN YOUR LAKE



What You Do Makes an Impact

WATER QUALITY

What is the water quality of your lake? Many lakefront owners may only guess the water quality of their lake unless it has a public beach or regular testing is done through CSLAP – Citizens Statewide Lake Assessment Program – or another watershed or lake association program. Truly polluted or damaged ecosystems may have lake water tested regularly to measure pollutants.

Clear water is not necessarily unpolluted and slight water coloration does not necessarily mean that the lake is polluted. While fishes and the benthic organisms they eat must have some algae as a food source and plants to eat and hide in, heavy algal blooms and mats may smother fish and too dense weeds may not allow fishes in their midst.

Algae problems are often caused by nutrients from fertilizers, leaking septic systems and sewers and manure. In lakes where the nutrients settle to the bottom, the algae may be persistent even after nutrient sources are removed. Harvesting and proper disposal of weeds and removal of vegetive mats will help decrease the nutrient load over time.



Fertilizers and pesticides should be used sparingly and only when necessary. Super green lawns will lead to super green lakes. Instead of using lawn fertilizers, use lake water to water your lawn once every month or two and have your lawn absorb

lake nutrients. Do not dump leaves and grass clippings into the lake and sweep grass clippings, leaves and other substances off paved areas such as driveways and walks.

Along with nutrients, leaking septic systems and sewers can increase the amount of bacteria such as E Coli, prescription and non-prescription drugs, and household chemicals. Lakeside residences should have their septic systems inspected and cleaned every two to three years when their tanks are one third full to reduce the possibility of septic contamination. Residences with sewers should report odors of sewage or dark, discolored, marshy areas near sewage pipes to their local municipality.

Canada geese and other waterfowl are also a large contributor to bacteria counts and should be discouraged by growing bushes and keeping grasses long by the water's edge.

SILTATION AND EUTROPHICATION

The natural process of lakes is for the lake to slowly fill in as it ages to become a shallow marsh. Although different types of lakes will age and fill in at different rates, many county lakes have been aging more rapidly than normal due to overabundance of nutrients and siltation from erosion. Erosion locations can be located on and around the lake or along upstream tributaries.

To prevent erosion into lakes, care must be taken around ground disturbances, especially in areas close to the lake, tributary streams and on slopes. Mulching and seeding of bare ground, the proper use of silt fencing, directing flow away from disturbed areas and phasing of disturbed areas can greatly reduce erosion from construction areas. Proper sizing of driveway and other culverts will keep stormwater from scouring ditches, driveways and stream banks.

Trees dissipate rain water, so the preservation and planting of trees will reduce rain water sheet flow, reducing erosion potential as well as the amount of nutrients picked up from lawns and gardens. Trees shading paved areas, streams and lakes also reduce thermal loading of streams from rain, providing a better fish habitat.



BOATS AND MOTORS

One of the greatest conflicts on the larger lakes is that of boating and use of motorized water craft. Several brochures can be written on the subject.

To prevent contamination of aquatic pests from one waterbody to another, **ALL** boats, motorized or not, should be washed down in an official wash area or on land away from streams or lakes. This is done to prevent the spread of zebra mussels, aquatic weeds and the like.

Also, all petroleum-fueled motors used in or around a lake, including outboard motors, lawn mowers, ATVs and automobiles, should be serviced and fueled in a manner that reduces the likelihood of contamination of the lake by gas or oil. Engines should, if possible, be fueled and serviced out of the water, on a level, impermeable surface such as concrete which does not have a drain to any water body or underground.

Prepared By: Rensselaer County Economic Development and Planning for the Rensselaer County MS4 Communities: cities of Rensselaer & Troy, towns of Brunswick, East Greenbush, Nassau, North Greenbush, Poestenkill, Sand Lake, Schaghticoke, and Schodack and village of Castleton-on-Hudson.

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North Greenbush MS4 Contact: Mike Miner, 283-3921
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Rensselaer MS4 Contact: Mike Brown, 465-1693
Sand Lake MS4 Contact: Mike Wager, 674-2026 x17
Schaghticoke MS4 Contact: Jean Carlson, 753-6915
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REMEMBER, you can make a difference one little action at a time.

Reducin' Pollution

***Hints for
Homeowners to
Save Money
while
Saving the Environment***





Test - Before fertilizing, test your soil. Whether fertilizing yourself or using a company, testing the soil ensures that fertilizers are used at the amounts needed. Fertilizing when you don't need to doesn't make your grass greener, just the lakes and streams near your property. An added plus is that you can save **\$\$\$\$** every time you don't need to fertilize! For those who use lawn care companies, make sure that they test, or you will be paying for something you don't need. Optimal PH 6.2-7.2 Contact Cooperative Extension for optimal nitrogen and phosphorus levels for your soils.



Calibrate - When fertilizing, calibrate your equipment to make sure that you are putting down the right amount. Putting down too little will make you need to go out and do it again. See the previous bullet about putting down too much. Also, keep a buffer around streams, lakes and rivers that's fertilizer free.



FREE!!! For lakefront property owners, recycle other's fertilizers. Use lake water (except Nassau Lake) to water your lawn once in the spring and in the fall. You'll use the nitrogen and phosphates from other's fertilizer, detergents and decaying leaves to fertilize your lawn and improve the water quality.



Lawn Clippings - Mulch them, compost them, or bag them. Don't dump them in the culvert, ditch, road, sidewalk or waterbody. They'll make a mess, as well as create the possibility of flooding and add nutrients to local lakes and streams.



STOP! Don't use pesticides unless you have pests. Pesticides are poisons. Unless you have pests, such as grubs, ants, and other destructive insects, don't use pesticides. Otherwise, you may poison yourself, your children and your pets. Along with fish, wildlife and other people. And always use and dispose of pesticides according to instructions.



PiNG - Maintain your engines. Cars, lawn mowers and even chain saws run better if they are properly maintained. Fix oil and other fluid leaks. Get a tune up. A properly functioning engine will save on gas, which will save you \$\$\$.

Dispose your old oil at your local car repair shop instead of dumping it down the catch basin or in the back yard.



PHEW! What's that Smell??? Take care of Fido's droppings. Flush it down the toilet. Get a pet waste composter. It will keep you from stepping on it and keep fishes from swimming with it.



SQUiSH - Seed that bare patch. Whether it's from insect infestation, construction or heavy foot traffic, bare soil can lead to erosion problems. Seed, mulch, or in the case of heavy foot traffic, put gravel or pavers down to cover the bare spots. It will also keep your shoes much cleaner.



FLUSH! Maintain that septic system. Have your septic tank pumped out regularly. Cost of septic system pumping - \$200 - \$400. Cost of replacing septic leach field - \$15,000 - \$20,000. And you won't have problems flushing or that annoying smell.



SPRAY! Wash that car in the lawn instead of on the paved driveway or roadway. The grass will absorb much of the chemicals being washed from your car, such as gasoline and oils. Use an environmentally friendly detergent. **OR**, take your car to a car wash that recycles and/or treats its wash water.



KEEP those trashcans tightly lidded and keep garbage from blowing into ditches and storm drains. Culverts and grates blocked by garbage are one of the most common reasons for local flooding.

What you should do if you see:

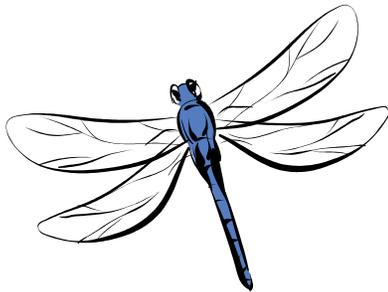
Oily sheen on the creek with no apparent cause:
call the DEC Region 4 Hotline

Sewage odors coming from an area in your yard:
Use a Septic Tank & System Service – see yellow pages

Sewage odors coming from an area in your neighbor's yard: *give them a copy of this pamphlet and encourage them to get their system serviced. If unsuccessful, call County Health Department*

Rusty color that does not smell like sewage but may have oily sheen on side of creek or in small stream: *this may be naturally occurring iron eating bacteria. There may be iron wastes in soils or fill near site.*

Green algae on rocks and/or bottom of creek:
Caused by too many nutrients in water due to over-fertilization of lawns and fields, leaking sewers and septic systems, build-up of rotting leaves in stream. Check your septic system, fertilize only when it is necessary, talk to your community about starting a watershed group.



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SO, YOU LIVE BY A CREEK?

TIPS ON MAINTAINING WATER QUALITY IN YOUR STREAM



What You Do Makes an Impact

Just 40 years ago, a house on a river, creek or stream may not have been many people's dream, due to pollution. Because of the Clean Water Act large polluters were made to clean up their act, making river- and creek -side living pleasant. Lately, water quality has not been increasing as it had a few decades ago, and in some places, water quality has degraded, due to overuse, misuse and surrounding land's uses that have contributed to pollution.

Whether you are located next to a small stream or the Hudson River, water quality can make the difference of a fresh water body with wildlife or a smelly body of water where the only animals to survive are mosquitoes and other biting insects.

We hope you will find this brochure educational on how to maintain and improve the quality of water in your river, creek or stream.

WILDLIFE

Clean streams, creeks and rivers are great places to see both water-based as well as land-based wildlife. Creeks and streams create a highway system for many animals such as moose, bear and otters searching for new territory as well as trekking to new food sources. Creeks and streams are the water sources for most wildlife and provide food sources such as lush plants, insects, frogs, fish, crayfish and smaller animals.

Aquatic animals such as frogs, fish, crayfish, birds and some insects eat insects and insect larvae, keeping the mosquito population in check. Loss of these animals in an aquatic ecosystem such as a creek can lead to increased pests such as mosquitoes.



Frogs and fish don't survive in dirty water. Even if the water looks clear, chemicals such as

pesticides and pharmaceuticals can sicken and reduce fertility of aquatic animal life as well as kill. Nutrients such as those found in lawn fertilizers or oil from motor vehicles can cause those icky algae masses which can suffocate streams and also creates hazardous substances when it rots. Oil from motor vehicles can also suffocate aquatic life.

Gravel washed into the creek from the erosion of yards, driveways and construction sites can bury fishes and frogs, with the coffee colored silt choking delicate gills. Heat from rainwater draining from hot parking lots and driveways, as well as from direct sunlight on creeks can kill sensitive fish populations such as trout.

To keep your river, creek or stream in healthy shape, use fertilizers and pesticides only when needed and only as directed on the instructions. Test your soils before adding fertilizers. Put up with a few weeds in your lawn. Dispose of household chemicals properly – at a hazardous waste day or at a facility permitted to deal with such wastes. Maintain your septic system and don't flush unused medicines down your toilet. Septic systems should be cleaned and inspected every 2 to 3 years, whenever the septic tank becomes 1/3 full.



Don't clear-cut stream banks but do maintain your trees on the stream bank. A fallen tree in a creek or river may require a permit from DEC for removal, depending on size and conditions. Use pavers and

gravel for walkways and driveways instead of asphalt. Keep vegetation by the creek side in a more natural state to slow pollutants. Follow the hints in the next section to reduce erosion from your property.

FLOODING

Man is the #1 cause of flooding problems. Placing fill along the banks of streams that creates impoundment problems, placing undersized culverts and creating straight, narrow ditches to quickly drain areas are some of the methods that increase flooding. Lots with large percentages of impervious surfaces – ground area where rain water can't sink in – increase the amount of water that reaches rivers and creeks during the early part of a rain storm. Siltation and gravel beds from erosion raise creek beds, providing less storage for water when the waters rise.

To reduce flooding threats, don't place fill in creeks and streams and make sure that stream culverts are properly sized for the stream and drainage basin. Undersized driveway culverts can lead to flooding by washing out surrounding yard and driveway, bringing gravel and silt into the receiving creek.

Reduce or eliminate erosion by seeding and mulching bare spots in lawns and construction sites. Don't cut slopes beyond the capacity of the soils unless using retaining walls or other retention methods. Don't dump leaves, brush or trash into roadside ditches. When working on drainage issues in your yard, create a rain garden or swale to allow water the chance to slow down and soak into the soil.

The mantra for reducing stormwater issues is "Slow it Down; Spread it Out; Soak it In!" Following these basic ideas will help reduce stormwater and flooding issues in local streams, rivers and lakes.

Exhibit 2

Pollutants of Concern

The Town of North Greenbush has worked with The Laberge Group to identify Pollutants of Concerns and Waterbodies of Concern that exist throughout the Town. Each of these items, while addressed in separate Exhibits, are closely related, particularly the way in which the Pollutants of Concern affect not only Waterbodies of Concern, but water quality and environmental and public health in general.

US EPA Stormwater Background

Stormwater runoff is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm our rivers, streams, lakes, and coastal waters. To protect these resources, communities, construction companies, industries, and others, use stormwater controls, known as Best Management Practices (BMPs). These BMPs filter out pollutants and/or prevent pollution by controlling it at its source.

Population growth and the development of urban/urbanized areas are major contributors to the amount of pollutants in the runoff as well as the volume and rate of runoff from impervious surfaces. Together, they can cause changes in hydrology and water quality that result in habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. The benefits of effective stormwater runoff management can include:

- Protection of wetlands and aquatic ecosystems,
- Improved quality of receiving waterbodies,
- Conservation of water resources,
- Protection of public health, and
- Flood control.

Traditional stormwater management approaches that rely on peak flow storage have generally not targeted pollutant reduction and can exacerbate problems associated with changes in hydrology and hydraulics.

Pollutants of Concern (POCs)

The Town watersheds, waterbodies, land uses and POCs have been identified based upon a worksheet type analysis, which has been attached to this Exhibit. The Potential Pollutants of Concern for the Town are:

- Bacteria and Viruses (BV);
- Gross Solids (GS);
- Nutrients (N);
- Pesticides and Herbicides (PH);
- Silt and Sediment (S);
- Pools and Fountains (PF);
- Organics (O); and
- Oil and Grease (OG).

Table 1 below lists contaminant types and their generally accepted sources.

Contaminant	Generally Accepted Contaminant Sources
Sediment and Floatables	Streets, Lawns, driveways, roads, construction activities, atmospheric deposition, drainage channel erosion
Pesticides and Herbicides	Residential lawns and gardens, roadsides, utility right-of-ways, commercial and industrial landscaped areas, soil wash-off
Organic Materials	Residential lawns and gardens, commercial landscaping, animal wastes
Oil and Grease / Hydrocarbons	Roads, driveways, parking lots, vehicle maintenance areas, gas stations, illicit dumping to storm drains
Bacteria and Viruses	Lawns, roads, leaky sanitary sewer lines, sanitary sewer cross-connections, animal waste, septic systems
Nitrogen and Phosphorous	Lawn fertilizers, atmospheric deposition, automobile exhaust, soil erosion, animal waste, detergents. <i>[Aquatic life is harmed by elevated levels of phosphorus and nitrogen in stormwater which lead to accelerated growth of algae and eutrophication]</i>
Source: US EPA NPDES Stormwater Pollution Documents Urban Stormwater Management in the United States National Research Council 2008	

Table 1: Contaminants and Generally Accepted Sources

Table 2 below summarizes typical stormwater pollutants, including a description of their common forms, as well as likely sources and normally associated land uses.

<u>Pollutant</u>	<u>Description</u>	<u>Likely Sources</u>	<u>Typical Associated Land Uses</u>
Bacteria and Viruses (BV)	Bacteria and viruses are pathogens present in fecal matter which get into stormwater runoff as pet waste, wildlife scat, leaky septic systems, runoff from agriculture, broken sanitary sewers, and cross connections where sanitary lines tie into stormwater lines.	Septic Systems, Aging Infrastructure; High Concentration of pet waste or droppings	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Gross pollutants include trash, cigarette butts and floatables as well as organic matter such as leaf litter and grass clippings. They can cause blockages in stormwater lines as well as other negative impacts.	Restaurants or stores producing trash; High Concentration of poorly maintained dumpsters; Known areas of sloppy pick up of trash	Retail

<u>Pollutant</u>	<u>Description</u>	<u>Likely Sources</u>	<u>Typical Associated Land Uses</u>
Nutrients (N)	Nutrients added to an aquatic environment can cause excessive algae growth and as the algae die the rate of decomposition increases causing oxygen to dramatically decrease. This is known as eutrophication and is harmful to fish other aquatic organisms.	Lawns or golf courses using extra fertilizers; Pet Waste; Goose Droppings	Lawns/Turf; Golf Courses; Agriculture; Professional Office Space; Schools
Organics (O)	Organics are chemical compounds that are used in the manufacturing of a large variety of products and even at low concentrations they can have serious health implications.	Businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial
Sediment (S)	Sediments commonly enter stormwater as particles washed off from impervious surfaces (rooftops, pavements) or as erosion from stream banks or construction sites. Excessive sedimentation can change the light penetration of water, clog the gills of fish and negatively impact the breeding and feeding of fish.	Active construction sites; Parking lots collecting sediments; Catch basins loaded with sediment	Impervious Pathways; Residential
Pools and Fountains (PF)	Water from the maintenance of pools, spas and fountains can pose a major risk for stormwater through erosion, increase in sediment and the addition of pollutants such as chlorine and acid wash.	High concentration of swimming pools or fountains	Residential; Parks; Retail
Vectors (V)	Improperly designed and/or maintained stormwater infrastructure offers several preferred habitat requirements for rodents, small animals, and other disease vectors.	Stormwater infrastructure with standing water in need of cleaning or maintenance	Stormwater Management
Thermal Stress (TS)	When warmer water from stormwater runoff enters a cold-water system it can negatively impact cold water dependent species. This is called thermal stress.	Are there exposed parking lots or roads near trout streams	Impervious; Residential; Retail; Industrial

<u>Pollutant</u>	<u>Description</u>	<u>Likely Sources</u>	<u>Typical Associated Land Uses</u>
Metals (M)	Common metals found in stormwater are copper, lead, cadmium, zinc, and nickel. Metals are a concern because of their potential toxicity and ability to bio-accumulate.	Junk/scrap yards or car shops near waterbodies	Retail; Industrial; Office Professional or Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	Pesticides can include anything from fungicides to insecticides, rodenticides, and herbicides. They get into stormwater by direct application as runoff.	High concentration of property owners using lawn care services; Particularly well-kept lawns and turf	Office Professional Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	The effects of oil and grease in stormwater include toxicity; the coating of plants and the gills of fish which can prevent the exchange of gases; and unpleasant harmful conditions for swimmers at recreational sites.	High concentration of car repair shops; Food service business or restaurants dumping cooked oil	Residential; Retail; Impervious

Table 2: Stormwater Pollutants, Their Descriptions, Effects and Likely Sources

Best Management Practices

Best Management Practices (BMPs) are applicable on a Town-wide basis and the Town is implementing a program in which the public will be educated and encouraged to reduce pollutants in stormwater runoff. The following BMPs actions, grouped by POC include:

- Bacteria and Viruses:
 - Clean up and properly dispose of pet waste;
 - Discourage concentrated wildfowl congregation;
 - Monitor septic system maintenance and performance and correct deficiencies; and
 - Monitor agriculture waste storage areas and appropriately manage.
- Gross Solids:
 - Properly dispose of trash;
 - Properly recycle, compost or dispose of landscape maintenance debris;
 - Minimize animal waste; and
 - Keeps streets and public areas free of litter.

- Nutrients:
 - Use fertilizers with reduced or no phosphorus and nitrogen;
 - Clean up and properly dispose of pet waste;
 - Discourage concentrated wildfowl congregation;
 - Monitor septic system maintenance and performance and correct deficiencies; and
 - Monitor agriculture waste storage areas and appropriately manage.
- Pesticides and Herbicides:
 - Follow manufacturer's instructions on proper application of chemicals (time, quantities);
 - Reduce or eliminate use (alternative methods);
- Silt and Sediment:
 - Use routine maintenance to reduce amounts of sediment and silt that may be washed off driveways and roadways (street sweeping);
 - Clean out catch basin;
 - Limit the duration of earth disturbance and stabilize upon cessation of activity; and
 - Perform channel stabilization routinely (inspect frequently and maintain).
- Pools and Fountains:
 - Neutralize acid wash before discharging;
 - Let pools drain slowly to prevent erosion at the discharge end;
 - Drain to lawn areas to increase filtering and infiltration and dilution of chlorinated water; and
 - Clean filters on lawn areas.
- Organics:
 - Proper storage and disposal of chemicals; and
 - Prevention of chemical dumping.
- Oil and Grease:
 - Proper maintenance of vehicles;
 - Perform hazardous waste collection programs;
 - Proper management and disposal of oil and grease.

POC Outreach Audience

Given the number of watersheds (or sub-watersheds) within the Town, the POCs and BMPs identified within this Exhibit are applicable on a Town-wide basis. To increase the effectiveness

of the Town's outreach and education program, specific likely sources of major POCs will be targeted, as follows:

- Residential Land Uses and new construction - Snyder's Lake Watershed;
- Residential developments / Home Owners - Town-wide;
- Commercial businesses and restaurants Town-wide;
- Car washes and laundromats Town-wide;
- Auto repair facilities and car sales garages Town-wide;
- New Construction & landscaping operations Town-wide;
- Commercial businesses and restaurants along Route 4; Town-wide; and
- Agricultural land use areas - Town-wide.

The MS4 General Permit, MCM 1: Public Education and Outreach, requires outreach to the general public and specific audiences to provide education on:

- The impacts of stormwater discharges on waterbodies;
- POCs and their sources;
- Steps that contributors of these pollutants can take to reduce pollutants in stormwater runoff; and
- Steps that contributors of non stormwater discharges can take to reduce pollutants.

Outreach efforts will be recorded periodically, assessed, and modified as needed with new, measurable goals established as necessary.

Measurable Goals

The Measurable Goals are applicable on a Town-wide basis. The following are measurable goals that the Town will work toward incorporating in a SWMP Plan update:

- Distribute handouts with information on POCs to Town residents (Examples included within this Exhibit). Record the quantity of handouts distributed.
- Post or otherwise make available stormwater educational materials in other public places.
- Continue with providing educational stormwater pamphlets in routine Town-wide mailings.

Town of North Greenbush

Rensselaer County

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TARGET AUDIENCE ANALYSIS WORKSHEET

A. Identified Watersheds within the Town of North Greenbush

1. Mill Creek
2. Wynants Kill (Lower)
3. Snyder's Lake
4. Tributaries to the Hudson River

MCM 1: Identify Pollutants of Concern (POCs) and Develop and Implement a Public Educational and Outreach Program to describe to the general public and target audiences: (i.) the impacts of *stormwater discharges* on waterbodies; (ii.) *POCs* and their sources; (iii.) steps that contributors of these pollutants can take to reduce pollutants in *stormwater* runoff; and (iv.) steps that contributors of non-*stormwater discharges* can take to reduce pollutants

- Record, periodically assess, and modify as needed, *measurable goals*;
- Select and implement appropriate education and outreach *activities* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the Maximum Extent Possible (*MEP*.)

B. List of Waterbodies of Concern (waterbodies within the identified watersheds) & their best use class

- Use the NYS DEC Waterbody Inventory/Priority Waterbodies List
- Use the NYSDEC online Environmental Resource Mapper to Identify the Best Use Class.

<i>Waterbody</i>	<i>Best Use Class</i>
1. Mill Creek	C (TS) = Non Contact Recreation / Trout Spawning
2. Wynants Kill	C (T) = Non Contact Recreation / Trout Habitat
3. Snyder's Lake	B = Public Swimming & Contact Recreation
4. Tributaries to the Hudson River	C = Non Contact Recreation (fishing)

New York waterbodies are assigned a "best use" classification. Best use classifications are:

- Class AA and A -- drinking water
- Class B -- public swimming and contact recreation activities
- Class C -- fishing and non-contact activities
- Class D -- does not support any of the uses listed above (this classification is rarely used)

Waterbodies with AA, A, B and C classifications may also have "T" or "TS" classifications, meaning they support trout populations or trout spawning.

C. Further refine the waterbodies of concern by listing them under the best use and indicate if they are Impaired with minor impacts, threatened, have possible threats or unknown or un-assessed.

- Use NYS DEC Water Inventory (WI) & Priority Waterbody List (PWL)

Additional Refinement of Waterbodies Best Use (Waterbody: WI/PWL classification)

A = Drinking	A (T) = Drinking Trout Habitat	A (TS) = Drinking /Trout Spawning Habitat	B = Contact Recreation (Swimming)	B (T) = Contact Recreation /Trout Habitat	C = Non Contact Recreation (Fishing)	C (T) = Non Contact Recreation (Trout Habitat)	C (TS) = Non Contact Recreation (Trout Spawning Habitat)	D = Lowest Classification
			<u>Snyder's Lake</u> Category: Minor impacts		<u>Tributaries to the Hudson River</u> Category: Un-assessed	<u>Wynants Kill</u> Category: Minor impacts	<u>Mill Creek</u> Category: No known impact	
			<u>Uses Impacted:</u> Recreation		<u>Uses Impacted:</u> None listed	<u>Uses Impacted:</u> Aquatic life	<u>Uses Impacted:</u> No use impairment	
			<u>Pollutants:</u> Algal/weed growth, nutrients (phosphorous)		<u>Pollutants:</u> None listed	<u>Pollutants:</u> Nutrients, silt/sediment, metals, priority organics, on-site septic systems, streambank erosion, sediment	<u>Pollutants:</u> None listed	
			<u>Likely Pollutant Source:</u> Nutrient recycling		<u>Likely Pollutant Source:</u> None listed	<u>Likely Pollutant Source:</u> Urban/storm runoff	<u>Likely Pollutant Source:</u> N/A	

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Pollutants of Concern (POC) Worksheet				
Name of Watershed: Mill Creek - Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 2.3 Sq. Mi. 12 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	1%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	6.49%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.01%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	5.93%	PH, N	Homeowners
	Golf Courses/Parks			
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	41.45%	PH, N, BV	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	33.99%		
X	Grassland	0.24%		
X	Wetlands	10.61%		
X	Water-Lakes, Ponds, Streams	0.29%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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Pollutants of Concern (POC) Worksheet				
Name of Watershed: Wynants Kill – Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 10.4 Sq. Mi. 53 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	2%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	15.96%	S, PF, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.45%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	11.57%	PH, N	Homeowners
	Golf Courses/Parks	%		
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	17.30%	PH, N, BV	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	39.43%		
X	Grassland	4.92%		
X	Wetlands	6.06%		
X	Water-Lakes, Ponds, Streams	2.34%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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Pollutants of Concern (POC) Worksheet				
Name of Watershed: Unnamed Tributaries – Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 6.8 Sq. Mi. 35 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	3%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	29.07%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	4.44%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	19.28%	PH, N	Homeowners
X	Golf Courses/Parks	0.51%	PH, N	Golf Course
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	18.43%	PH, BV, N	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	21.97%		
	Grassland	%		
X	Wetlands	1.93%		
X	Water-Lakes, Ponds, Streams	1.37%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.

Pollutants of Concern (POC) Worksheet				
Name of Watershed: Snyder's Lake (included in Wynants Kill watershed)				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 1.1 Sq. Mi. 6 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	0.5%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	16.05%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.06%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
	<u>Green Areas</u>			
	<i><u>Man-made:</u></i>			
X	Lawns/turf	11.68%	PH, N	Homeowners
	Golf Courses/Parks	%		
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	21.24%	PH, BV, N	Farms
	Stormwater Management	%		
	<i><u>Natural:</u></i>			
X	Forest	31.55%		
X	Grassland	0.85%		
X	Wetlands	2.45%		
X	Water-Lakes, Ponds, Streams	15.6%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				

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Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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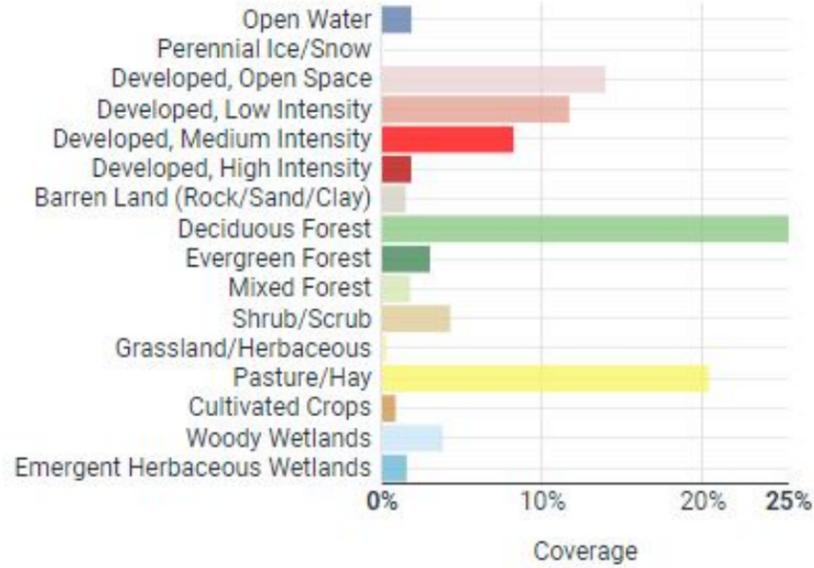
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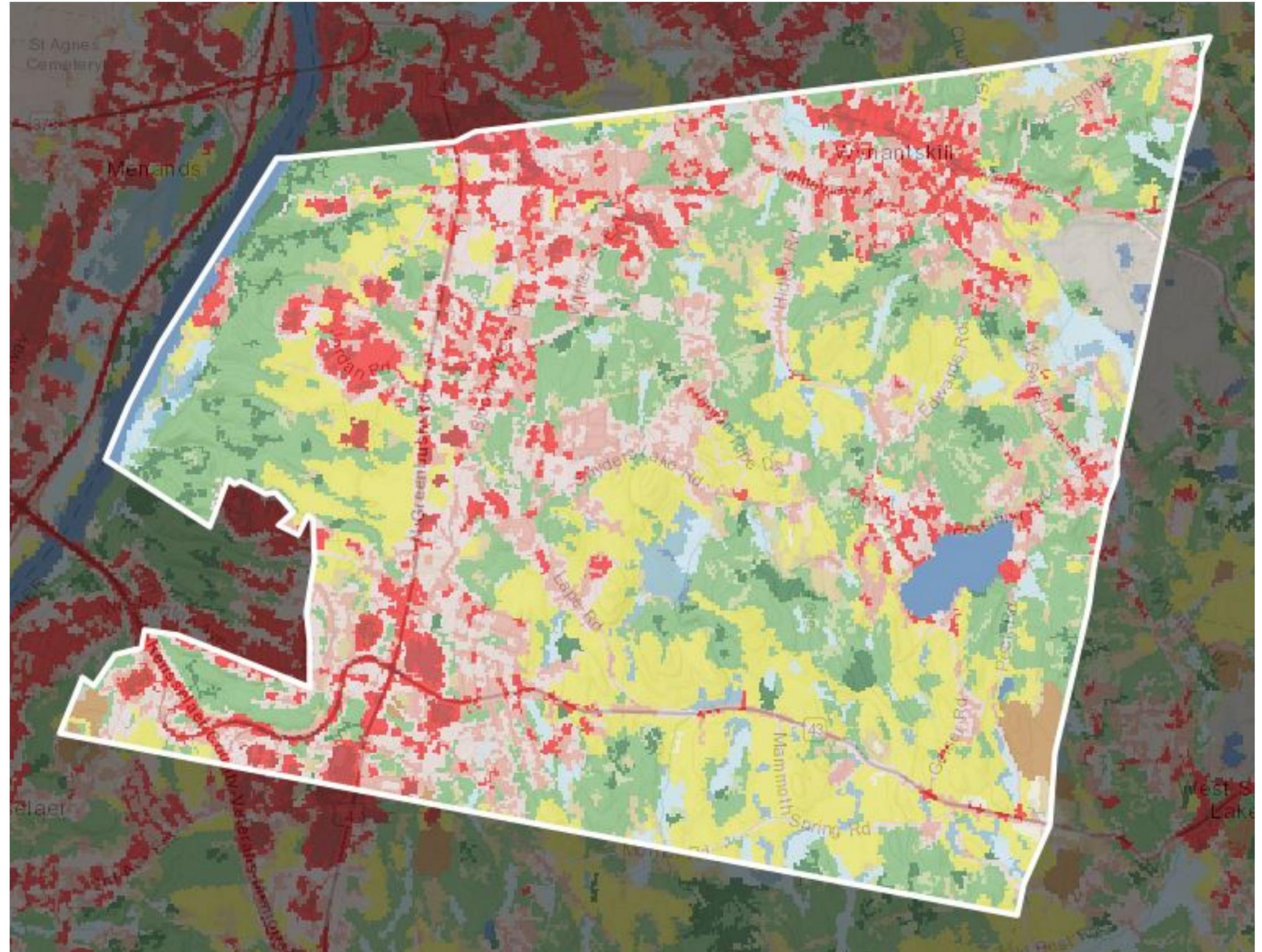


Town of North Greenbush Land Cover Map



Type	Area (km ²)	Coverage (%)
Open Water	0.89	1.76%
Perennial Ice/Snow	0	0.00%
Developed, Open Space	6.87	13.55%
Developed, Low Intensity	5.76	11.36%
Developed, Medium Intensity	4.04	7.97%
Developed, High Intensity	0.9	1.77%
Barren Land (Rock/Sand/Clay)	1.63	3.21%
Deciduous Forest	12.51	24.67%
Evergreen Forest	1.48	2.92%
Mixed Forest	1	1.97%
Shrub/Scrub	2.28	4.50%
Grassland/Herbaceous	0.25	0.49%
Pasture/Hay	10.05	19.82%
Cultivated Crops	0.42	0.83%
Woody Wetlands	1.87	3.69%
Emergent Herbaceous Wetlands	0.76	1.50%
Total	50.71	100.00%

Type	Coverage (%)
Agricultural	±20%
Developed	±33%
Retail/Mixed	±2%
Forests & Wetlands	±40%





Bacteria

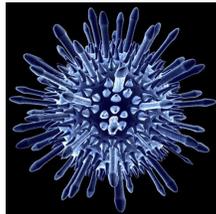


<http://www.ecoliblog.com/2006/06/>

E. Coli

Pathogens

Viruses



<http://www.turbosquid.com/3d-models/3d-adenovirus-science/484353>

Adenovirus

General Information

Bacteria and viruses are pathogens present in fecal matter which get into stormwater runoff as pet waste, wildlife scat, leaky septic systems, runoff from agriculture, broken sanitary sewers, and cross connections where sanitary lines tie into stormwater lines. Excess amounts of these pathogens can make water unsafe to drink and force the closure of water recreational areas, such as beaches. Indicator species are used to monitor beaches for unsafe levels of pathogens. The 3 main indicators used by the EPA (1986 standards) are E. coli, Enterococcus and fecal coliform. Many of these pathogens can cause severe stomach ailments and disease. If levels of indicator species get too high, officials often close down beaches, which can negatively impact local businesses.

Best Management Practices

- Clean up after pets: flush waste down toilet; never put waste in storm drains; bag the waste.
- Monitor septic systems to ensure they are not cracked or leaking.
- Manage and control wildlife populations. Ex. Rats or raccoons in storm sewers and Canadian geese.
- Monitor agriculture waste storage areas and remove excess.
- Report suspicious odors to authorities.

Additional Information

EPA

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=4

NYSDEC

Section 2.1 of the 2010 NYS Stormwater Management Design Manual - <http://www.dec.ny.gov/chemical/29072.html>

Other

<http://www.deq.state.or.us/wq/pubs/factsheets/willamette/bacteria.pdf>

<http://www.bae.ncsu.edu/stormwater/PublicationFiles/PathogensSW.2008.pdf>

Pet Waste and Wildlife



<http://www.geeserelief.net/>

Cross Connections

Ex. The sanitary line is connected to a dry well. The dry well drains to a roadside ditch, which is near a stream.



Leaky Septic Systems

Ex. This failing septic system is draining to a roadside ditch.





Catch Basin Almost Entirely Blocked by Debris



Litter and Organic Debris Blocking a Storm Drain



Cigarette Butts on Sidewalk



General Information

Gross solids include trash, cigarette butts and floatables as well as organic matter such as leaf litter and grass clippings. Trash can cause storm systems to not function properly due to blockages and provide habitat for vectors such as mosquitoes. Nutrients, such as phosphorus and nitrogen, found in organic matter, can be pollutants.

Best Management Practices

- Street sweeping, litter cleanups, stream cleanups, recycling programs and neighborhood cleanups.
- Use of gross solid reducing devices that are appropriate for the situation such as catch basin opening screen covers, catch basin inserts, hydrodynamic separators and end of pipe devices to name a few.
- Monitor gross solids in stormwater (location, weight, size, etc...)
- Proper maintenance of all structures including cleaning out when needed.
- Public education regarding litter and phosphorus laws, overall impacts of gross solids and what citizens can do to reduce this impact.

Additional Information

EPA

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=5&minmeasure=1>

NYSDEC

Sections 2.2 and 10.1.2 of the 2010 NYS Stormwater Design Manual - <http://www.dec.ny.gov/chemical/29072.html>

Other

<http://www.water.ncsu.edu/watershedss/info/norganics.html>

<http://www.stormwater.ucf.edu/conferences/9thstormwatercd/documents/ASCEguidelines.pdf>

<http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-03-072.pdf>



Excess Algae



Pet Waste and Wildlife



<http://www.geeserelief.net/>

Lawn Care Products and Car Wash



Washing Vehicles on the lawn helps prevent soap from washing into the storm drain.

Use lawn care products, such as fertilizer, with care.



<http://sunnymesainfo.wordpress.com/>

General Information

Nutrients added to an aquatic environment can cause excessive algae growth and as the algae die the rate of decomposition increases causing the oxygen to dramatically decrease. This is known as eutrophication and is harmful to fish and other aquatic organisms. Phosphorous and nitrogen are two main contributing nutrients that are associated with eutrophication. They are found in products used for lawn care, detergents, car wash and animal waste including pets, livestock and wildlife. Flocks of geese in urban settings especially are becoming more of a concern because of their large numbers.

Best Management Practices

- Use lawn care products with reduced or no phosphorous or nitrogen.
- Read and follow directions carefully when applying lawn care products.
- Do not wash vehicles where the soapy water will go into the storm drain. Areas that have porous pavement or lawns are more appropriate because the soapy water is infiltrated into the soil.
- Clean up and properly dispose of pet waste and manage livestock to prevent them from entering water bodies.
- Take necessary steps to control wildlife populations including geese and don't encourage concentrated feeding of these animals.

Additional Information

EPA

<http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/problem.cfm>

NYSDEC

Section 2.1 of the 2010 NYS Stormwater Management Design Manual - <http://www.dec.ny.gov/chemical/29072.html>

<http://www.dec.ny.gov/chemical/69489.html>

Other

<http://icwdm.org/handbook/birds/CanadaGeese/HumanHealthWater.aspx>



Pesticide Application Warning Sign



Read Labels With Care—Follow The Directions



Oriental Beetle Trap Used as Part of an Integrated Pest Management Program



<http://www.pestmanagement.rutgers.edu/ipm/vegetable/photogallery.htm>

General Information

Pesticides can include anything from fungicides to insecticides, rodenticides, and herbicides. They get into stormwater by direct application or as runoff. Pesticides are extremely variable in their effect on humans and the environment. For humans, these effects can be minor, such as skin or stomach irritations to major, including cancer and neurological effects. Environmental effects have a similar range, from no effect to serious impacts on water quality and wildlife. Some pesticides also have the potential to cause biomagnifications in the food chain. This means that potentially harmful chemicals can be carried up the food chain in higher and higher concentrations.

Best Management Practices

- Labels should be read with care and all directions should be followed to the letter.
- Cumulative effects of pesticide application of a large area should be considered.
- Other pest deterring methods should be used in conjunction in order to reduce the need for chemical pesticides.
- Participate in Integrated Pest Management (IPM) training through organizations like Cornell Cooperative Extension
- Develop and participate in public education and outreach programs which communicate the concerns and proper usage of pesticides.

Additional Information

EPA

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=98

<http://www.epa.gov/pesticides/>

<http://www.epa.gov/pesticides/factsheets/ipm.htm>

<http://www.epa.gov/nbh/pdfs/BioaccumulationBiomagnificationEffects.pdf>

NYSDEC

Section 2.1 of the 2010 NYS Stormwater Management Design Manual - <http://www.dec.ny.gov/chemical/29072.html>

Other

<http://www.water.ncsu.edu/watershedss/info/pest.html>

<http://npic.orst.edu/>

<http://www.nysipm.cornell.edu/>



Rain Washing Away Sediment from a Bare Building Lot



Erosion of a Stream Bank



Person Sweeping Up Sidewalk



General Information

Sediments commonly enter stormwater as particles washed off from impervious surfaces (pavement, rooftops) or as erosion from stream banks or construction sites. Excessive sedimentation can change the light penetration of water, clog the gills of fish, negatively impact feeding and breeding in fish, and damage aquatic plants. Sediment also transports pollutants, such as bacteria, pathogens, nutrients and metals and can accumulate within stormwater infrastructure causing backups and flooding.

Best Management Practices:

- Sweep driveways of sediment after gardening or home improvement projects.
- Contact local municipalities to learn about state and local laws and mandatory erosion and sediment controls.
- Evaluate slope, soil type, proximity to a water body or stormwater infrastructure and time of year before beginning a project.
- Limit the amount of exposed soil for a project and protect vegetation that is already there.
- Regularly clean out and remove sediment from stormwater structures.
- Monitor sites to make sure erosion control efforts are installed correctly and working properly.

Additional Information:

EPA

<http://water.epa.gov/polwaste/sediments/>

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=59

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=32>

NYSDEC

<http://www.dec.ny.gov/chemical/29066.html>

Other

<http://www.dot.ca.gov/hq/construc/stormwater/temposoilstabilizationguide.pdf>



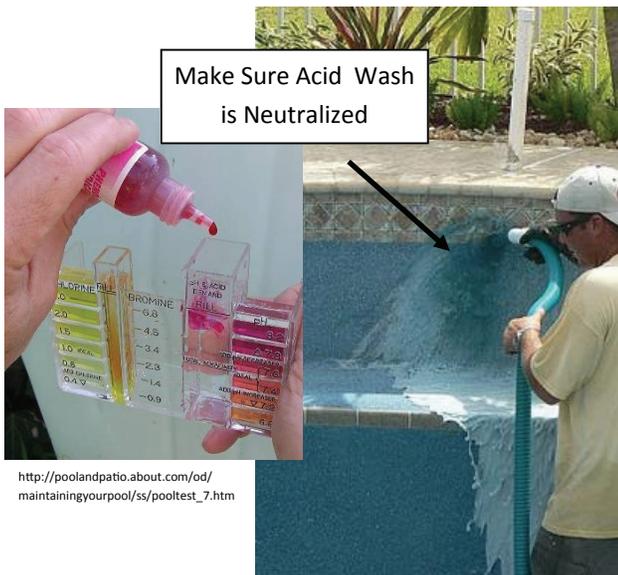
Drain Pools, Fountains and Spas Slowly to the Lawn



<http://nativesunpools.com/add%20services.html>

<http://grono.co.uk/artificial-grass/item/Grono-Lawns-Beat-The-Hose-Pipe->

Person Acid Washing A Concrete Swimming Pool



Make Sure Acid Wash
is Neutralized

http://poolandpatio.about.com/od/maintainingyourpool/ss/pooltest_7.htm

<http://civil-engg-world.blogspot.com/2011/12/concrete-swimming-pool-basics.html>

Clean Pool Filters on Lawn



Prevent Runoff
into Street and
Catch Basins

<http://photos.nondot.org/2008-08-24-PoolFilter/normal/01%20-%20Cleaning%20the%20filter.jpg>

General Information

Water from the maintenance of pools, spas and fountains can pose a major risk for stormwater through erosion, increase in sediments and the addition of pollutants such as chlorine and acid wash. High pressure, high volume hoses used to drain can increase erosion at the drainage site or by adding more volume quickly to the storm drains and causing a problem downstream. Cleaning filters near storm drains can add volume and sediment to stormwater. Chlorine easily dissolves in water and reacts with other chemicals. It can cause harm to aquatic and soil organisms even at low levels. Acid wash, if not properly neutralized can lower the PH levels of stream habitats potentially beyond the tolerable levels of native aquatic organisms.

Best Management Practices

- Do not drain chlorinated water directly into the street of storm sewer or clean filter near a storm sewer.
- Let water stand for around 10 days prior to discharging in order for chlorine to dissipate, then drain to lawn.
- Clean filters on lawn area where water will be absorbed into the ground.
- Let pools, spas and fountains drain slowly with low volume.
- Make sure acid wash used to clean pools is neutralized before discharging.
- Read and follow directions carefully for all chemicals used in pool, spa and fountain maintenance.

Additional Information

EPA

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=103>

http://www.epa.gov/chemfact/f_chlori.txt

NYSDEC

http://www.dec.ny.gov/docs/materials_minerals_pdf/hhwma.pdf

Other

<http://www.arlingtontx.gov/environmentalservices/pdf/StormwaterSwimmingPool.pdf>

http://www.stormwateralbanycounty.org/wp-content/uploads/2011/12/2009_Pool_Spa_SWCoal_Brochures_EMAIL_FINAL_11-4.pdf



Organics Found in a Typical Household Garage



Spilled Paint Draining to the Storm System



Hazardous Waste Collection Program



General Information

Organics are chemical compounds that are used in the manufacturing of a large variety of products including paint, household cleaners, solvents, pharmaceuticals, pesticides, fuel and plastics. They can be volatile or synthetic non-volatile and even at low concentrations they can have serious health implications including skin and eye irritation, effects on the nervous system, and cancer. Some common forms of contamination of stormwater from organics are direct dumping, spills and improper storage and disposal.

Best Management Practices

- Hazardous waste collection programs.
- Public education and outreach programs that encourage the use of alternative, less hazardous products.
- Follow disposal directions carefully and address spills immediately.

Additional Information

EPA

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=104>

NYSDEC

http://www.dec.ny.gov/docs/materials_minerals_pdf/hhwma.pdf

Other

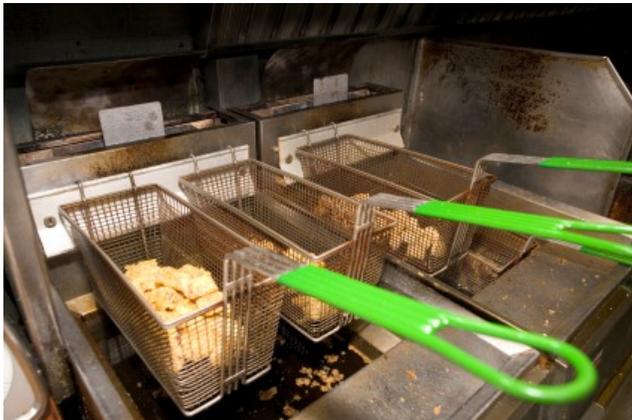
<http://www.water.ncsu.edu/watershedss/info/organics.html>



Oil Sheen in a Parking Lot



Oil and Grease from Cooking



<http://www.pricemykitchen.com/tag/fryers-2/>



<http://www2.oaklandnet.com/Government/o/PWA/DOWD000876>

General Information

Oil and grease is made of hydrocarbons which even at low concentrations can be toxic. Effects of oil and grease in stormwater include toxicity; the coating of plants and the gills of fish which can prevent the exchange of gases; and unpleasant potentially harmful conditions for swimmers at recreational sites. Oil and grease can also build up in the infrastructure causing backups. Sources include but are not limited to automobiles not properly maintained; spills on driveways, roadways and in garages; and improper disposal of cooking oil.

Best Management Practices

- Proper maintenance of vehicles.
- Whenever practical use green infrastructure practices like porous pavement and vegetative buffers that promote the infiltration of stormwater into soil and removal of pollution through natural processes.
- Address spills immediately and make sure they are cleaned up.
- Hazardous waste collection programs.
- Clean grease traps regularly.
- Don't pour grease into sinks, floor drains, trash bins, street gutters or parking lots.
- Public education and outreach programs informing people of proper management and disposal methods and spill cleanup procedures for oil and grease.

Additional Information

EPA

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=95

NYSDEC

Section 2.1 of the 2010 NYS Stormwater Management Design Manual - <http://www.dec.ny.gov/chemical/29072.html>

Other

<http://www.seas.ucla.edu/stenstro/j/j21>

<http://www.waynesboro.va.us/pw-es-oil.php>

<http://www.kingcounty.gov/environment/waterandland/stormwater/introduction/science.aspx>

Exhibit 3

Spill Response Procedures

The Town of North Greenbush (Town) expects contractors, businesses, industries and others conducting work within the Town to have a Spill Response Plan (SRP) in place prior to commencing work. The SRP shall be a function of the materials involved and the potential risk associated with an unplanned release. A copy of the SRP should be kept in the vicinity of the work being performed and should also be reviewed with the Fire Marshall/Code Enforcement Officer or local fire department.

In many instances, Town employees are often the first to respond to spills, some of which can be potentially hazardous and may pose a danger to human health and the environment. Ideally, these spills should be contained with prompt and decisive actions to minimize the potential danger and impact. The response to a spill will depend on several factors, including the location, quantity, and type of material discharged. Additionally, spills are classified according to one of three risk categories:

- **Low Risk:** A Low Risk spill is one which meets all of the following: the spilled material is known and is not toxic; the quantity of the spill is small and it can be easily and safely cleaned using conventional materials or a standard spill kit; there is no fire hazard present; and the spill can be completely contained and the material has little or no potential to enter a stormwater system of surface waters of New York State.
- **Minor Risk:** A Minor Risk spill is one that does not pose a risk to human health, or the environment, and has not entered a stormwater system or surface waters of New York State.
- **Major Risk:** A Major Risk spill is one in which: the spilled material is hazardous or unknown; the spill is of a known non-hazardous material but is of a quantity requiring substantial cleanup; poses a risk to the first responder, public or environment; or has entered the stormwater system or surface waters of New York State.

The general procedure for responding to a spill is as follows:

1. Assess the Situation and Secure the Area

- Determine the Risk Category for the spill. Only approach known spills of Low or Minor Risk. Call 911 immediately for High Risk spills and wait for First Responders at a safe distance.
- Keep individuals away from the spill area and implement traffic control as necessary.
- Contact the Building Department.

2. Contain the Spill

- Do not engage in any activity that is potentially harmful. If in question, contact 911 and wait for assistance.
- Wear the appropriate PPE for the situation.
- Establish a safe work zone, considering: the location of the spill; pedestrian and vehicular traffic; material spilled; quantity of spill; potential cleanup effort; and public/municipal safety.

- If the spilled material is known and non-toxic, install countermeasures such as booms, plugs, or other impermeable barriers to contain the flow of material and prevent the spilled material from reaching stormwater systems, waters of New York State or pervious surfaces such as soil or grass.

3. Clean Up the Material

- If possible to do so for Low and Minor Risk spills, clean up the spilled material with granular absorbents, vermiculite, absorbent pads or other appropriate materials. Use materials to their capacity and do not over-saturate. Employ a second application of clean-up materials as necessary.
- Collect, dispose of, and mark/label clean-up material as per industry standards, established protocols, manufacturer's recommendations or regulatory guidelines for the material used.
- Employ professional clean-up services as necessary for any spill beyond a volume that can be handled with available resources, has entered a stormwater system or waters of New York State, or has soaked into a pervious surface.
- If safe to do so, remove work zone and other exclusion area measures.

4. Report the Spill

- For Low Risk spills, contact the Building Department.
- For Minor Risk spills, contact 911 if necessary, the Building Department, and the Fire Marshall or Fire Department. Additional reporting to DEC may be necessary once the spill event has passed.
- For Major Risk spills, contact 911, the Building Department, the Fire Marshall or Fire Department. Additional reporting to DEC and potentially other regulatory agencies will be necessary once the spill event has passed.

For reporting, the following information is required:

- Date, time and location of the spill;
- Type of material spilled;
- Type of clean-up material used;
- Name and contact information of the responsible party; and
- The current status of the incident.

5. Identify the Responsible Party

- If not present, attempt to locate the party responsible for the spill through observations, interviews or source tracing.
- If applicable, collect contact information for the Responsible Party and provide this information to the Building Department.
- Indicate to the Responsible Party that it is responsible for the final and proper removal and disposal of spilled and clean-up materials. If the Responsible Party does not or can not handle this responsibility in a timely manner, the Town may initiate clean-up and

disposal actions and may back-charge the Responsible Party. Activities undertaken by the initial respondents does not relieve or limit the Responsible Party from any obligations.

6. Document the Response

- Details of the spill shall be sent to the Building Department that include:
 - The time, location, type and quantity of spilled material, and type and quantity of absorbent material used;
 - A description of the spill event and if the spill entered any stormwater systems or waters of New York State;
 - The Responsible Party, including contact information;
 - The spill respondent and other clean-up entities;
 - The party who disposed of the spill and clean-up materials;
 - Any known property damage or personal injuries; and
 - The regulatory entities (DEC, ACOE, etc) contacted as part of the spill.

The Town will retain submitted records in an attempt to establish a spill database.

As an additional resource, the following New York State Department of Environmental Conservation document is included with this Exhibit:

- Chemical and Petroleum Spills



Chemical and Petroleum Spills

[The Problem](#) | [The Response](#)

Accidental releases of petroleum, toxic chemicals, gases, and other hazardous materials occur frequently throughout New York State. Even small releases have the potential to endanger public health and contaminate groundwater, surface water, and soils. What is being done about this problem? How can concerned citizens help? The information presented here can answer these and other questions.

The Problem

Every year, the New York State Department of Environmental Conservation receives approximately 16,000 reports of confirmed and suspected releases to the environment. Approximately ninety percent of those releases involve petroleum products. The rest involve various hazardous substances, unknown materials, or other materials such as untreated sewage and cooking grease.



Environmental damage from such releases depends on the material spilled and the extent of contamination. Many of these reports are releases of small quantities, typically a few gallons, that are contained and cleaned up quickly with little damage to the environment. In other instances material releases seep through the soil and eventually into the groundwater, which can make water supplies unsafe to drink. Vapors from spilled materials can collect in houses and businesses, creating fire and explosion hazards. Uncontained spills, especially those that impact surface water, can kill or injure plants, fish, and wildlife, and cause damage to their habitats.

The Response

New York State (NYS) responds to reports of petroleum and other hazardous material releases through the Spill Response Program maintained by the NYS Department of Environmental Conservation (DEC). Spill response staff throughout the State investigate such spill reports and take action based on the type of material spilled, the potential environmental damage, and safety risks to the public.

Both immediate response and continued cleanup vary depending on the type of material spilled and the damage caused. Federal and State law require the spiller, or responsible party, to notify government agencies and to contain, clean up, and dispose of any spilled/contaminated material in order to correct any environmental damage.

This may be performed by a qualified contractor hired by the responsible party. Any delay in containing or recovering a release allows contaminants to spread and may result in more extensive damage and more expensive cleanups. DEC can provide additional resources to local agencies during emergencies and will remain involved if continued cleanup of the environment is required. Continued cleanup is the responsibility of the spiller and is required if contamination and environmental damage remain after the initial containment and recovery. Again, this work may be performed by a qualified contractor hired by the responsible party. Continued cleanup may include determining the extent of contamination, selecting a cleanup technology, and completing corrective actions. The DEC will oversee the process to ensure the actions are protective of public safety, health and the environment.



The public can notify DEC of releases to the environment by calling the NYS Spill Hotline. Federal agencies can be notified by calling the National Response Center.

NYS Spill Hotline: 1-800-457-7362

National Response Center: 1-800-424-8802

For further information, contact:

New York State Department of Environmental Conservation

Division of Environmental Remediation

Bureau of Technical Support

625 Broadway - 11th Floor

Albany, NY 12233-7020

(518) 402-9543

More about Chemical and Petroleum Spills:

[Geographic Response Plans \(GRPs\)](#) - These plans are map-based and are used by first responders during the initial stages of an incident that involves the transportation of oil.

[Public Record of Underground Storage Tank Releases](#) - New York State's Public Record of underground storage tank (UST) releases includes the number, sources and causes of UST releases along with data on the number of UST equipment failures in the State.

[Tips for Keeping Gasoline and Household Chemicals Out of Your Water Supply](#) - Gasoline is one of the most dangerous chemicals you will encounter on a regular basis. Here are some suggestions for keeping your water supply safe.

[Spill Response & Remediation FAQ](#) - Division of Environmental Remediation FAQs - Frequently Asked Questions on New York's Oil Spill Response & Remediation Program.

Exhibit 4

Current General Permit

This Exhibit contains a copy of the current SPDES General Permit No. GP-0-15-003 for reference as well as a copy of GP-0-20-001, which is in the process of being adopted.



Department of
Environmental
Conservation

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SPDES GENERAL PERMIT
FOR STORMWATER DISCHARGES

From

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)

Permit No. GP-0-15-003

Issued Pursuant to Article 17, Titles 7, 8 and Article 70
of the Environmental Conservation Law

Effective Date: May 1, 2015

Expiration Date: April 30, 2017

Modification Dates

July 15, 2015 - Correction of Table IX.C and Appendix 2 to reflect GP-0-10-002 October
2011 Modification

January 13, 2016 - Additional reporting for covered entities in the watersheds listed in
Part IX

Stu Fox
Deputy Chief Permit Administrator


Authorized Signature

1 / 12 / 16

Date

Address: NYS DEC
Division of Environmental Permits
625 Broadway, 4th Floor
Albany, N.Y. 12233-17

PREFACE

Pursuant to Section 402 of the Clean Water Act (“CWA”), operators of *small municipal separate storm sewer systems* (“small MS4s”), located in *urbanized areas* (“UA”) and those *additionally designated* by New York State are unlawful unless they are authorized by a *National Pollutant Discharge Elimination System* (“NPDES”) permit or by a state permit program. New York’s *State Pollutant Discharge Elimination System* (“SPDES”) is an NPDES-approved program with permits issued in accordance with the *Environmental Conservation Law* (“ECL”).

Only those *small MS4 operators* who *develop* and *implement* a *stormwater management program* (SWMP) and obtain permit coverage in accordance with Part II of this *SPDES general permit* are authorized to *discharge stormwater* from their *small MS4* under this *SPDES general permit*.

A *covered entity* authorized under GP-0-10-002 as of the effective date of GP-0-15-003, shall be permitted to discharge in accordance with the renewed permit, GP-0-15-003, upon the submission of their Annual Report, unless otherwise notified by the *Department*.

An *operator* not authorized under GP-0-15-003 may¹ obtain coverage under this *SPDES general permit* by submitting a Notice of Intent (NOI) to the address provided on the NOI form. For newly regulated MS4s, authorization under this *SPDES general permit* is effective upon written notification from the *Department* of the receipt of a complete NOI. Copies of this *SPDES general permit* and the NOI for New York are available by calling (518) 402 - 8109 or at any Department of Environmental Conservation (*Department*) regional office (Appendix A). They are also available on the *Department’s* website:

<http://www.dec.ny.gov/permits/6045.html>

Submitting an NOI is an affirmation that an initial *SWMP* has been *developed* and will be *implemented* in accordance with the terms of this *SPDES general permit*.

*** Note: all italicized words within this *SPDES general permit* are defined in Part X. Acronyms and Definitions.**

¹ The term “may” is used to recognize that there are circumstances under which the *operator* is ineligible for coverage under this *SPDES general permit* because of exclusionary provisions of this permit. *Operators* that are excluded from coverage under this *SPDES general permit* as provided for in Part I, for example, are not authorized to *discharge* under this permit. This clarification also applies to situations in which an NOI has been submitted; submission of an NOI by an entity excluded from *SPDES general permit* coverage does not authorize the *small MS4* to *discharge stormwater* runoff under the authority of this *SPDES general permit*.

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
 SPDES GENERAL PERMIT FOR DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)**

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Part I. PERMIT COVERAGE AND LIMITATIONS

A. Permit Application

1. This *SPDES general permit* authorizes *discharges* of stormwater from *small municipal separate storm sewer systems* (“MS4”s) as defined in 40 CFR 122.26(b)(16), provided all of the eligibility provisions of this *SPDES general permit* are met.
2. Exempt Non-Stormwater Discharges. The following non-stormwater *discharges* are exempt from the need for *SPDES general permit* coverage unless the *Department* has determined them to be substantial contributors of pollutants to a particular *small MS4* applying for coverage under this *SPDES general permit*. If the *Department* determines that one or more of the *discharges* listed below is a substantial contributor of pollutants to a *small MS4*, the identified *discharges* will be considered *illicit*. In that event, the *covered entity* must eliminate such discharges by following the *illicit discharge* minimum control measure (“MCM”) requirements (See Part VII.A.3 or VIII.A.3, and Part IX.A.3, B.3, C.3, and D.3 where applicable).
 - a. water line flushing
 - b. landscape irrigation
 - c. diverted stream flows
 - d. rising ground waters
 - e. uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
 - f. uncontaminated ground water
 - g. discharges from potable water sources
 - h. foundation drains
 - i. air conditioning condensate
 - j. irrigation water
 - k. springs
 - l. water from crawl space and basement sump pumps
 - m. footing drains
 - n. lawn and landscape watering runoff provided that all pesticides and fertilizers have been applied in accordance with the manufacturer’s product label;
 - o. water from individual residential car washing
 - p. flows from riparian habitats and wetlands
 - q. dechlorinated swimming pool discharges
 - r. residual street wash water
 - s. discharges or flows from firefighting activities

(Part I.A.2.)

- t. dechlorinated water reservoir discharges
- u. any SPDES permitted discharge.

Even if the non-stormwater discharges are determined not to be substantial contributors of pollutants, the *Department* recommends that the *covered entity's stormwater management program* ("SWMP") include public education and outreach activities directed at reducing pollution from these discharges.

B. Limitations on Coverage

The following are not authorized by this *SPDES general permit*:

1. *Stormwater discharges* whose unmitigated, direct, indirect, interrelated, interconnected, or interdependent impacts would jeopardize a listed endangered or threatened species or adversely modify designated critical habitat;
2. *Stormwater discharges* or *implementation* of a *covered entity's SWMP*, which adversely affect properties listed or eligible for listing in the National Register of Historic Places, unless the covered entity is in compliance with requirements of the National Historic Preservation Act and has coordinated with the appropriate State Historic Preservation Office any activities necessary to avoid or minimize impacts;
3. *Stormwater discharges* to territorial seas not of the State of New York, the contiguous zone, and the oceans unless such *discharges* are in compliance with the ocean *discharge* criteria of 40 CFR 125 subpart M;
4. *Stormwater discharges*, the permitting of which is prohibited under 40 CFR 122.4 and/ or the *ECL*;

C. Exemption Criteria

For *stormwater discharges* from a designated *small MS4* that are mixed with non-*stormwater* or *stormwater* associated with *industrial activity*, the *Department* may determine them to be exempt from the requirements of this *SPDES general permit* if the *discharges* are:

1. Effectively addressed by and in compliance with a different *SPDES general permit* or an *individual SPDES permit*; or
2. Identified by and in compliance with Part I.A.2 of this *SPDES general permit*.

Part II. OBTAINING PERMIT COVERAGE

A. Permit coverage is obtained by submission of a complete and accurate Notice of Intent.

B. Permit coverage is public noticed by the Department.

NOIs will be public noticed and an opportunity for public comment provided on the contents of submitted NOIs.

a. NOIs and the location of the SWMPs and Annual Reports for existing MS4s will be posted in the Environmental Notice Bulletin (ENB).

b. A deadline of 28 calendar days from the posting in the ENB will be provided for receiving comments.

c. After the public comment period has expired, the *Department* may extend the public comment period, require submission of an application for an individual SPDES permit or alternative *SPDES general permit*, or accept the NOI or SWMP as complete.

C. Continuance of Permit Coverage for Covered Entities Authorized by GP-0-10-002 (Continuing Covered Entities)

As of May 1, 2015, entities with coverage under GP-0-10-002 will continue to have authorization to discharge on an interim basis for up to 180 days from the effective date of this *SPDES general permit*. Covered entities may gain coverage under this *SPDES general permit* by submission of their 2014 Annual Report due in June 2015. For public participation purposes, the updated Annual Report will be considered equivalent to submission of an NOI.

When the operator changes, a new operator is added, or the individual responsible for the SWMP changes, these changes must be indicated on the MCC form submitted in accordance with Part V.D. It is not necessary to submit a revised Notice of Intent (NOI).

D. Permit Coverage for Covered Entities Newly Designated Under GP-0-15-003 (Small MS4s not Previously Authorized by GP-0-10-002)

Certain *small MS4s* designated by 40CFR Section 122.32(a)(1) were not authorized by GP-0-10-002, but are now required to gain coverage under this *SPDES general permit*. The *small MS4s* were not previously authorized because they were either:

- required to gain coverage under GP-0-10-002, but were granted a waiver from that requirement;
- were not required to gain coverage under GP-0-10-002 based on the designation criteria, but they are now within an *Additionally Designated Area*; or

(Part II.D.)

- were otherwise not permitted under GP-0-10-002.
- 1. In order for *stormwater discharges* from *small MS4s* to be newly authorized under this *SPDES general permit*, an operator must:
 - a. within 180 days of receiving written notification from the *Department* that a permit for discharges from MS4s is required, prepare an NOI using the form provided by the *Department* (or a photocopy thereof); and
 - b. submit the NOI, signed in accordance with Part VI.J of this *SPDES general permit*, to:

NOTICE OF INTENT
NYS DEC, Bureau of Water Permits
625 Broadway, 4th Floor
Albany, NY 12233-3505

- 2. *Operators* who submit a complete NOI in accordance with the requirements of this *SPDES general permit* are authorized to *discharge stormwater* from *small MS4s*, under the terms and conditions of this *SPDES general permit*, upon written notification from the Department that a complete NOI has been received.

E Small MS4s Not Required to Gain Coverage

Operators of unregulated *small MS4s* may apply for coverage under this *SPDES general permit* at any time, per Part II.B.

F. Extension of Permit Coverage to Covered Entity's Full Jurisdiction

Operators of traditional land use control MS4s must extend the implementation of minimum control measures (MCMs) 4 and 5 in accordance with *Criterion 3* of the Designation Criteria or apply for a waiver, if eligible.

Operators of all regulated *small MS4s* may also extend the implementation of any of the six MCMs to areas under their control, but outside of the existing area covered by this *SPDES general permit*. This may be done by describing the program components (MCMs) being extended and the geographic extent to which they are being extended in the annual report (Part V.C.) and indicating in the Municipal Compliance Certification (MCC) form (Part V.D.) that the program was extended to the *covered entity's* full jurisdiction.

(Part II.)

G. Single Entity to Cover the MS4

A single entity may gain coverage for, and on behalf of, one or more regulated MS4s to implement a part of an MCM, one, or all the MCMs. A single entity shall be defined by watershed, municipal boundaries, special district boundaries, or other specifically defined boundaries. The single entity must demonstrate to the *Department* that it was formed in accordance with applicable state and/or local legislation, and that it has the legal authority and capacity (financial, resources, etc.) to meet the requirements of this *SPDES general permit*. Depending on the MCM(s) implemented, the single entity shall demonstrate that it has the following capacities, as applicable for each MCM that the single entity is seeking coverage under this *SPDES general permit*:

1. Initiate and administer appropriate enforcement procedures,
2. Collect, finance, bond or otherwise borrow money for capital projects,
3. Control the management and operation of the storm sewer system,
4. Implement best management practices at all municipal facilities discharging to the MS4, and
5. Obtain access to property that may be necessary for siting stormwater management facilities and/or practices.

The single entity must submit a complete NOI form to the *Department*, detailing which of the regulated MS4s it will gain coverage for and which of the MCMs, or parts of MCMs, it will implement for each particular regulated MS4. A copy of the document forming the single entity, and detailing the legal authority and capacity of the single entity, must be attached to the NOI. Prior to the single entity gaining coverage under this *SPDES general permit*, each regulated MS4, for which the single entity will implement one or more MCM must submit a complete notice of termination (NOT). This notice shall specify which of the minimum control measures the single entity will implement for the MS4 and which of the minimum control measures the MS4 will implement.

Part III. SPECIAL CONDITIONS

A. Discharge Compliance with Water Quality Standards

Where a *discharge* is already authorized under this *SPDES general permit* and is later determined to directly or indirectly cause or have the reasonable potential to cause or contribute to the violation of an applicable *water quality standard*, the *Department* will notify the *covered entity* of such violation(s) and may take enforcement actions for such violations. The *covered entity* must take all necessary actions to ensure future *discharges* do not directly or indirectly cause or contribute to the violation of a *water quality standard*, and the *covered entity* must document these actions in the *SWMP*.

(Part III.A.)

Compliance with this requirement does not preclude, limit, or eliminate any enforcement activity as provided by the Federal and / or State law for the underlying violation. Additionally, if violations of applicable water quality standards occur, then coverage under this *SPDES general permit* may be terminated by the *Department* in accordance with 750-1.21(e), and the *Department* may require an application for an alternative *SPDES general permit* or *individual SPDES permit* may be issued.

B. Impaired Waters

1. Impaired Waters Without Watershed Improvement Strategies or Future TMDLs

If a *small MS4 discharges* a stormwater pollutant of concern (POC) to an *impaired* water listed in Appendix 2, the covered entity must ensure no net increase in its *discharge* of the listed *POC* to that water.

By January 8, 2013, *covered entities* must assess potential sources of discharge of stormwater *POC(s)*, identify potential stormwater pollutant reduction measures, and evaluate their progress in addressing the *POC(S)*. Newly authorized covered entities must perform the above tasks within 5 years after gaining coverage under this *SPDES general permit*. Covered entities must evaluate their *SWMP* with respect to the *MS4's* effectiveness in ensuring there is no net increase discharge of stormwater *POC(s)* to the impaired waters for *storm sewersheds* that have undergone non-negligible changes such as changes to land use and impervious cover greater than one acre, or stormwater management practices during the time the *MS4* has been covered by this *SPDES general permit*. This assessment shall be conducted for the portions of the *small MS4 storm sewershed* that *discharge* to the listed waters (see Appendix 2). The assessment shall be done using *Department* supported modeling of pollutant loading.

If the modeling shows increases in loading of the *POC*, the *SWMP* must be modified to reduce the loading to meet the no net increase requirement. The subsequent annual reports must contain an assessment of priority stormwater problems, potential management practices that are effective for reduction of stormwater *POC(s)*, and document a gross estimate of the extent and cost of the potential improvements.

2. Watershed Improvement Strategies

The *SWMPs* for *covered entities* in the watersheds listed below must be modified to comply with the following requirements and the watershed improvement strategies. *Covered entities* implementing the pollutant-specific *BMPs* in addition to the *BMPs* required of all *covered entities* will be taking satisfactory steps towards achieving compliance with *TMDL* requirements. *Covered entities* under the *MS4 SPDES general*

(Part III.B.2.)

permit are required to make best efforts to participate in locally based watershed planning efforts that involve the NYSDEC, other covered entities, stakeholders and other interested parties for implementation of load reduction BMPs. Covered entities may form a Regional Stormwater Entity (RSE) to implement stormwater retrofits collectively. The *covered entities* must ensure that discharges of the *POC* to the *TMDL* waterbody are reduced through these or additional changes to the *SWMP* so that the waste load allocation is met.

MS4s are required to meet the reduction of the POC defined by the TMDL program defined in Part IX of this *SPDES general permit*. By the deadlines defined in Part IX of the general permit, *covered entities* must assess their progress and evaluate their *SWMP* to determine the *MS4's* effectiveness in reducing their discharges of *TMDL POC(s)* to *TMDL* water bodies. Newly designated watershed improvement strategy areas must perform the assessment within 5 years from authorization under this *SPDES* general permit. This assessment shall be conducted for the portions of the *small MS4 storm sewershed* that are within the *TMDL* watershed. The assessment shall be done using *Department* supported modeling of pollutant loading from the *storm sewershed*. The *covered entities* or an RSE must prepare and implement, participate in or utilize the results of existing or ongoing ambient water quality monitoring programs to validate the accuracy of models and evaluate the effectiveness of the additional *BMPs* for watershed improvement strategies.

If the modeling shows that loading of the POC is not being reduced to meet the waste load allocation, the *SWMP* must be modified to reduce the pollutant loading to meet the waste load allocation.

Each regulated MS4 is responsible for an individual load reduction, which is a fraction of the total required load reduction in the TMDL. If MS4s form an RSE and stormwater retrofits are approached collectively, the *Department* would allow compliance with this condition of the *SPDES* general permit to be achieved on a regional basis.

In this case the load reduction requirement for each participating MS4 will be aggregated, to create an RSE load reduction, to allow design and installation of retrofits where they are most feasible, without restricting MS4s to site retrofit projects within their municipal boundaries.

Each member of an RSE is in compliance if the aggregate reduction number associated with the retrofit plans is met. If the aggregate number is not met, each of the participating MS4s would be deemed non-compliant until such time as they had met their individual load reduction requirements.

(Part III.B.2.)

a. New York City Watershed East of the Hudson River

Covered entities shall modify their *SWMP* to meet the additional requirements as set forth in Part IX.A to address phosphorus as the *POC* for the portion of their *storm sewershed* in the watershed. A map of the watershed is shown in Appendix 3.

b. Other Phosphorus Watersheds

Covered entities shall modify their *SWMP* to meet the additional requirements as set forth in Part IX.B to address phosphorus as the *POC* for the portion of their *storm sewershed* in the watershed. Maps of the watersheds are shown in Appendices 4, 5, and 10.

c. Pathogen Watersheds

Covered entities shall modify their *SWMP* to meet the additional requirements as set forth in Part IX.C to address pathogens as the *POC* for the portion of their *storm sewershed* in any of the watersheds. Maps of the watersheds are shown in Appendices 6, 7, and 9.

d. Nitrogen Watersheds

Covered entities shall modify their *SWMP* to meet the additional requirements as set forth in Part IX.D to address nitrogen as the *POC* for the portion of their *storm sewershed* in the watershed. Maps of the watersheds are shown in Appendix 8.

3. Future TMDL Areas

If a *TMDL* is approved in the future by EPA for any waterbody or watershed into which a *small MS4 discharges*, the *covered entity* must review the applicable *TMDL* to see if it includes requirements for control of *stormwater discharges*. If a *covered entity* is not meeting the *TMDL* wasteload allocations, it must, within 180 days of written notification from the *Department*, modify its *SWMP* to ensure that the reduction of the *POC* specified in the *TMDL* is achieved. It will be the *MS4's* obligation to meet the waste load allocations specified in the *TMDL* through modification of its *SWMP plan* according to the schedule of Part IX of this *SPDES general permit*.

Modifications must be considered for each of the six MCMs. Refer to assistance documents or enhanced requirements for specific pollutants in documents on the *Department's* website for modifications specific to the *TMDL*. Revised *SWMPs* must include updated schedules for implementation.

(Part III.B.3.)

Within three years of having modified its SWMP to ensure that reduction of the POC specified in the TMDL is achieved, covered entities in future TMDL areas must assess their progress and evaluate their *SWMP* to determine the *MS4's* effectiveness in reducing their discharges of *TMDL POC(s)* to *TMDL* water bodies. This assessment shall be conducted for the portions of the *small MS4 storm sewershed* that are within the *TMDL* watershed. The assessment shall be done using *Department* supported modeling of pollutant loading from the *storm sewershed*.

Part IV. Stormwater Management Program (SWMP) Requirements

A. SWMP Background

Covered entities must develop (for newly authorized *MS4s*, implement), and enforce a *SWMP* designed to reduce the discharge of pollutants from *small MS4s* to the *maximum extent practicable* (“MEP”) in order to protect water quality and to satisfy the appropriate water quality requirements of the *ECL* and the *CWA*. The objective of the permit is for *MS4s* to assure achievement of the applicable water quality standards. *Covered entities* under GP-0-10-002 must have prepared a *SWMP plan* documenting modifications to their *SWMP*. See Part X.B. (Definitions) for more information about the *SWMP* and *SWMP plan*.

The *SWMP* and *SWMP plan* may be created by an individual *covered entity*, by a shared effort through a group or coalition of individual *covered entities*, or by a third party entity. The *SWMP plan* shall be made readily available to covered entity’s staff, to the public and to *Department* and EPA staff.

B. Cooperation Between Covered Entities Encouraged

The *Department* encourages *covered entities* to cooperate when *developing* and *implementing* their *SWMP*². However, each *covered entity* is responsible for obtaining its own permit coverage and for filing its own NOI. Irrespective of any agreements between *covered entities*, each individual *covered entity* remains legally responsible for satisfying all GP-0-15-003 requirements and for its own *discharges*. If one *covered entity* is relying on another *covered entity* to satisfy one or more of its permit obligations, that fact must be noted on the *covered entity's* MCC form. The other entity must, in fact,

² For example, villages are encouraged to cooperate with towns, towns with counties, and adjacent counties with each other. In addition, municipal governments are encouraged to coordinate and cooperate with non-traditional *MS4s* such as DOT, school and fire districts, Federal and State facilities located within and adjacent to their jurisdictions. Sewer boards, water boards, or other non-traditional entities are encouraged to partner with the municipality (municipalities) that they serve.

(Part IV.B.)

implement the MCM(s) and must agree to *implement* the MCM(s) on the first *covered entity's* behalf. This agreement between the two or more parties must be documented in writing and signed by both (all) parties. Part IV.G. below may apply if such an agreement is not already in place. The agreement must be included in the *SWMP plan*, and be retained by the *covered entity* for the duration of this *SPDES general permit*, including any administrative extensions of the permit term.

Covered entities that are working together to *develop (for newly authorized MS4s)* or *implement* their *SWMPs* are encouraged to complete shared annual reports. *Covered entities* may also hold a group meeting to present their annual reports to the public and to receive comments on their annual reports. These options are discussed in more detail in Part V.C.2.

C. SWMP Coverage Area

At a minimum, *covered entities* are required to *develop (for newly authorized MS4s)* and *implement SWMPs* in the automatically designated *urbanized areas* ("UA") and *additionally designated* areas (40CFR Section 122.32(a)(1) or 122.32(a)(2)) under their jurisdiction³.

SWMP coverage shall include all UA or additionally designated areas within the *covered entity's* jurisdiction that drain into their *small MS4* and subsequently *discharge* to *surface waters of the State* directly or through other *small MS4s*.

Operators of *small MS4s* whose jurisdiction includes regulated and unregulated areas are encouraged to include their entire jurisdiction in their *SWMP* (refer to Part II.D).

D. SWMP Development and Implementation for Covered entities Authorized by GP-0-10-002(Continuing Covered entities)

Covered entities authorized under GP-0-10-002 shall continue to fully *implement* their *SWMP*, unless otherwise stated in this *SPDES general permit*. A *covered entity* may modify its *SWMP* if it determines changes are needed to improve *implementation* of its *SWMP*. Any changes to a *SWMP* shall be reported to the *Department* in the *MS4's*

³ The purpose of this section is to minimize conflicts between adjacent *small MS4s*. For the purposes of this *SPDES general permit*, areas under the *covered entity's* jurisdiction shall mean areas where the legal authority exists for the subject *covered entity* to *develop* and *implement* an *SWMP* including the six MCMs. It is not a permit requirement for *covered entities* to *implement* and enforce any portion of their *SWMP* in any area that is under the jurisdiction of another *covered entity*. For example, if a portion of a town drains directly into a stormwater system owned and operated by the State DOT, and this area of the town is regulated, the DOT will not be required to implement and enforce any portion of a *SWMP* in the area lying outside of its right of way. In this case, the town would be required to implement the program in the subject area in accordance with this *SPDES general permit*, this despite the fact that the subject drainage does not directly enter the town's system.

(Part IV.D)

annual report and Municipal Compliance Certification (MCC) form (See Part V.C and V.D).

E. SWMP Development and Implementation for Newly Regulated Covered entities (Small MS4s not Previously Authorized by GP-0-10-002)

Certain *small MS4s* designated by 40CFR Section 122.32(a)(1) were not authorized by GP-0-10-002, but are now required to gain coverage under this *SPDES general permit*. The *small MS4s* were not previously authorized because they were either:

- required to gain coverage under GP-0-10-002, but were granted a waiver from that requirement;
- were not required to gain coverage under GP-0-10-002 based on the designation criteria, but they now meet the additional designation criteria in NYS DEC “Designation Criteria for Identifying Regulated Municipal Separate Storm Sewer Systems” ; or
- were otherwise not permitted under GP-0-10-002.

Operators of small MS4s newly regulated under this *SPDES general permit* must *develop* an initial *SWMP* and provide adequate resources to fully *implement* the *SWMP* no later than three years from the date of the individual MS4's authorization.

A newly regulated *covered entity* may modify its *SWMP* to comply with the terms and conditions of this *SPDES general permit* if it determines changes are needed to improve *implementation* of its *SWMP*. Any changes to a *SWMP* shall be documented in the *SWMP plan* and reported to the *Department* in the annual report (See Part V.C).

Covered entities are required to make steady progress toward full *implementation* in the first three years after the date of authorization. Full *implementation* of *SWMPs* for newly regulated *small MS4s* is expected no later than three years from the date of coverage under this *SPDES general permit*.

F. Minimum Control Measures

Each *covered entity* is required to develop (*for newly authorized MS4s*) and implement a *SWMP* that satisfies the requirements for each of six required program components, known as minimum control measures (MCMs).

The MCMs for *traditional land use control MS4s* are listed in Part VII. The MCMs for *traditional non-land use control MS4s* and *non-traditional MS4s* are listed in Part VIII. Additional MCMs that *covered entities* in watersheds with improvement strategies must address, referred to in Part III.B.2, are described in Part IX.

(Part IV.)

G. Reliance Upon Third Parties

This section applies when a *covered entity* relies upon any third party entity to *develop* or *implement* any portion of its *SWMP*. Examples of such entities include, but are not

limited to a non-government, commercial entity that receives payment from the *covered entity* for services provided (for example businesses that create policies or procedures for *covered entities*, perform illicit discharge identification and track down, maintain roads, remove snow, clean storm sewer system, sweep streets, etc. as contracted by the covered entity).

The covered entity must, through a signed certification statement, contract or agreement provide adequate assurance that the third parties will comply with permit requirements applicable to the work performed by the third party. The certification statement, contract or other agreement must:

- provide adequate assurance that the third party will comply with permit requirements;
- identify the activities that the third party entity will be responsible for and include the name and title of the person providing the signature;
- the name, address and telephone number of the third party entity;
- an identifying description of the location of the work performed; and
- the date the certification statement, contract or other agreement is signed.

Example certification language is provided below:

Contracted Entity Certification Statement:

“I certify under penalty of law that I understand and agree to comply with the terms and conditions of the (covered entity’s name) stormwater management program and agree to implement any corrective actions identified by the (covered entity’s name) or a representative. I also understand that the (covered entity’s name) must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System (“SPDES”) general permit for stormwater discharges from the Municipal Separate Storm Sewer Systems (“MS4s”) and that it is unlawful for any person to directly or indirectly cause or contribute to a violation of water quality standards. Further, I understand that any non-compliance by (covered entity’s name) will not diminish, eliminate, or lessen my own liability.”

Part V. PROGRAM ASSESSMENT, RECORD KEEPING, REPORTING AND CERTIFICATION REQUIREMENTS

A. Assessment

Covered entities are required to collect and report information about the *development* and *implementation* of their SWMPs. Specific information the *small MS4s* are required to collect is identified in Parts VII or VIII, depending on the type of *small MS4*. The *small MS4s* are encouraged to collect additional information that will help them evaluate their SWMP. Collection of information over time will facilitate the evaluation of the *covered entity's SWMP* by allowing the examination of trends in the information collected.

The *covered entity* must conduct an annual evaluation of its program compliance, the appropriateness of its identified *BMPs*, meeting new permit requirements, and progress towards achieving its identified *measurable goals*, which must include reducing the *discharge* of pollutants to the *MEP*.

Where the evaluation shows that the SWMP is not reducing discharges to the *MEP*, the SWMP shall be revised to reduce discharges to the *MEP*. Update to the SWMP and the SWMP plan must be completed within a year from the annual evaluation of their SWMP with an implementation schedule no later than 3 years from the annual evaluation.

B. Recordkeeping

The *covered entity* must keep records required by this *SPDES general permit* (records that document *SWMP*, records included in *SWMP plan*, other records that verify reporting required by the permit, NOI, past annual reports, and comments from the public and the *Department*, etc.) for at least five (5) years after they are generated. Records must be submitted to the *Department* within 5 business days of receipt of a *Department* request for such information. The *covered entity* shall keep duplicate records (either hard copy or electronic), to have one copy for public observation and a separate working copy where the *covered entity's* staff, other individuals responsible for the *SWMP* and regulators, such as *Department* and EPA staff can access them. Records, including the NOI and the *SWMP plan*, must be available to the public at reasonable times during regular business hours.

C. Annual Reporting

1. Annual Report Submittal

The annual reporting period ends March 9 of each year. The annual report must be received in the *Department's* Central Office, electronic or hard copy, no later than June 1 of each reporting year. If electronic, submit in accordance with procedures set forth by the *Department*. If mailed, send to the address below:

(Part V.C.1.)

**NYS DEC “MS4 Coordinator”
Bureau of Water Permits
625 Broadway, 4th Floor
Albany, NY 12233-3505**

Failure to submit a complete annual report and a complete MCC form (Part V.D) shall constitute a permit violation.

a. Annual Report Submittal for Newly Regulated Covered entities (Small MS4s not Previously Authorized by GP-0-10-002)

Newly regulated covered entities *developing* their *SWMP* are to submit their Annual Report in a format provided by the *Department*. They will provide, at a minimum, the information on the annual report form and the information required by Parts VII or VIII.

Newly regulated *covered entities* are required to submit their first annual report the year that authorization is granted if authorization is granted on or before December 31 of that reporting year.

b. Annual Report Submittal for Covered entities Authorized by GP-0-10-002 (Continuing Covered entities)

Beginning with annual reports due in 2010 *covered entities* implementing their *SWMP* shall submit, at a minimum, information specified by the *Department* in Part VII or VIII in a format provided by the *Department*.

2. Shared Annual Reporting and Submittal

Covered entities working together to *develop* (for newly authorized *MS4s*) and /or *implement* their *SWMPs* may complete a shared annual report. The shared annual report is an annual report that outlines and explains group activities, but also includes the tasks performed by individual *covered entities* (*BMPs*, *measurable goals*, schedules of planned activities, etc.). To facilitate the submission of one annual report for the entire group of *covered entities*, individual *covered entity*'s activities may be incorporated into the report by either:

- providing the details specific to their *small MS4(s)* to a person(s) who incorporates that information into the group report. That one group report is submitted to the *Department* for all participating *small MS4s*; or
- providing the details specific to their *small MS4(s)* on a separate sheet(s) that will be attached with the one group report.

(Part V.C.2.)

Regardless of the method chosen, each *covered entity* must, by June 1 of the annual reporting year:

- a. Provide their individual MCC form (see Part V.D) to be submitted with the shared annual report. Each *covered entity* must sign and submit an MCC form to take responsibility for all of the information in the annual report, which includes specific endorsement or acceptance of the shared annual report on behalf of the individual *covered entity*;
- b. Present their draft annual report at a meeting (see Part VII.A.2.d or Part VIII.A.2.d for more information). For completed shared annual reports, the report may be presented by each participating individual *covered entity* at an existing *municipal* meeting or may be made available for comments on the internet. Additionally, *covered entities* participating in shared annual reporting may combine meetings to have a group or regional meeting. While the group meeting is allowable, each *covered entity* shall ensure that local public officials and members of the public are informed about the program, activities and progress made; and
- c. Submit a summary of any comments received and (intended) responses on the individual *covered entity's* information or the shared annual report information, as applicable. This information should be included with the annual report submission. Changes made to the *SWMP* in response to comments should be described in the annual report.

3. Annual Report Content

The annual report shall summarize the activities performed throughout the reporting period (March 10 to March 9) and must include at a minimum:

- a. The status of compliance with permit conditions, including Watershed Improvement Strategy conditions;
- b. An assessment/evaluation of:
 - i. the appropriateness of the identified *BMPs*;
 - ii. progress towards achieving the statutory goal of reducing the *discharge* of pollutants to the *MEP*; and
 - iii. the identified *measurable goals* for each of the *MCMs*.
- c. Results of information collected and analyzed, monitoring data, and an assessment of the *small MS4's SWMP* progress toward the statutory goal of reducing the *discharge of pollutants* to the *MEP* during the reporting period. This could include results from required *SWMP* reporting, estimates of pollutant loading (from parameters such as identified illicit discharges, physically interconnected *small MS4s* that may contribute substantially to pollutant

loadings from the *small MS4*) and pollutant load reductions (such as illicit discharges removed). This assessment may be submitted as an attachment;

- d. When required to be completed, results of assessments of effectiveness in meeting no net increase requirements or TMDL loadings as required by III. B.1 and 2. These results must be submitted in evaluation forms and as an attachment;
- e. A summary of the stormwater activities planned to be undertaken during the next reporting cycle (including an implementation schedule);
- f. Any change in identified *BMPs* or *measurable goals* and justification for those changes;
- g. Notice that a *small MS4* is relying on another entity to satisfy some or all of its permit obligations (if applicable);
- h. A summary of the public comments received on this annual report at the public presentation required in Part VII.A.2. or VIII.A.2. And, as appropriate, how the *small MS4* will respond to comments and modify the program in response to the comments;
- i. A statement that the final report and, beginning in 2009, the SWMP plan are available for public review and the location where they are available; and
- j. The information specified under the reporting requirements for each MCM (Part VII or VIII).

D. Interim Progress Reporting

In accordance with 6 NYCRR Part 750-1.14, *covered entities* that own or operate MS4s within the watersheds listed in Part IX must submit to the Department interim progress reports no later than December 1 of each year. These interim progress reports will identify the activities that have been performed during the period of March 10 through September 9 of each year, which demonstrates that there is progress being made by the *covered entity* towards completion of the reduction requirements, prescribed in Part IX. Progress made during the period of September 10 through March 9 shall be reported with the annual report that is due no later than June 1 of each year.

E. Annual Report Certification

A signed original hard copy and a photocopy of the MCC form must be submitted to the *Department* no later than June 1 of each reporting year. If the annual report is mailed (Part V.C. above), the MCC form must be submitted with the annual report.

The MCC form, provided by the *Department*, certifies that all applicable conditions of Parts IV, VII, VIII and IX of this *SPDES general permit* are being *developed, implemented* and complied with. It must be signed by an individual as described in Part VI.J.2. The certification provided by the MCC form does not affect, replace or negate the certification required under Part VI.J.2 (d). If compliance with any requirement cannot be certified to on the MCC form, a complete explanation with a description of corrective measures must be included as requested on the MCC form.

Failure to submit a complete annual report (Part V.C.) and a complete MCC form shall constitute a permit violation.

Part VI. STANDARD PERMIT CONDITIONS

A. General Authority to Enforce

Three of the MCMs (illicit discharge detection and elimination, construction site *stormwater* runoff control and post-construction *stormwater* management) require local laws, ordinances or other regulatory mechanisms to ensure successful implementation of the MCMs. Some *covered entities*, however, are not enabled by state law to adopt local laws or ordinances. Those *covered entities* (typically non-traditional MS4s and traditional, non-land use control MS4s) are expected to utilize the authority they do possess to create or modify existing regulatory mechanisms, including but not limited to contracts, bid specifications, requests for proposals, etc. to ensure successful implementation.

B. Duty To Comply

A *covered entity* must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the CWA and the *ECL* and is grounds for enforcement action.

C. Enforcement

Failure of the *covered entity*, its contractors, subcontractors, agents and/or assigns to strictly adhere to any of the *SPDES general permit* requirements contained herein shall constitute a permit violation. There are substantial criminal, civil, and administrative penalties associated with violating the provisions of this permit. Fines of up to \$37,500 per day for each violation and imprisonment for up to fifteen (15) years may be assessed depending upon the nature and degree of the offense.

D. Continuation of the Expired SPDES General Permit

This *SPDES general permit* expires five years from the effective date of this permit. However, an administratively extended *SPDES general permit* continues in force and effect until the *Department* issues a new permit, unless a *covered entity* receives written notice from the *Department* to the contrary. *Operators* of the *MS4s* authorized under the administratively extended expiring *SPDES general permit* seeking coverage under the new *SPDES general permit* must refer to the terms within the new *SPDES general permit* to continue coverage.

E. Technology Standards

Covered entities, in accordance with written notification by the *Department*, must comply with all applicable technology-based effluent standards or limitations promulgated by EPA pursuant to Sections 301 and 304 of the CWA. If an effluent standard or limitation more stringent than any effluent limitation in the *SPDES general permit* or controlling a pollutant not limited in the permit is promulgated or approved

(Part VI.E.)

after the permit is issued, the *SWMP plan* shall be promptly modified to include that effluent standard or limitation.

F. Need To Halt or Reduce Activity Not a Defense

It shall not be a defense for a *covered entity* in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this *SPDES general permit*.

G. Duty to Mitigate

The *covered entity* shall take all reasonable steps to minimize or prevent any *discharge* in violation of this *SPDES general permit* which has a reasonable likelihood of adversely affecting human health or the environment.

H. Duty to Provide Information

The *covered entity* shall, within five (5) business days, make available for inspection and copying or furnish to the *Department* or an authorized representative of the *Department* any information that is requested to determine compliance with this *SPDES general permit*. Failure to provide information requested shall be a violation of the terms of this *SPDES general permit* and applicable regulation.

I. Other Information

Covered entities who become aware of a failure to submit any relevant facts or have submitted incorrect information in the NOI or in any other report to the *Department* must promptly submit such facts or information.

J. Signatory Requirements

All NOIs, reports, certifications or information submitted to the *Department*, or that this *SPDES general permit* requires be maintained by the *covered entity*, shall be signed as follows:

1. Notices of Intent

All NOIs shall be signed by either a principal executive officer or ranking elected official. Principal executive officer includes (1) the chief executive officer of the municipal entity agency, or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports Required and Other Information Requested

All reports required by this *SPDES general permit* and other information requested by the *Department*, including MCC forms (part V.D.), shall be signed by a person

(Part VI.J.2.)

described above or by a duly authorized representative of that person⁴. A person is a duly authorized representative only if:

- a. The authorization is made in writing by a person described in VI.J.1 above and submitted to the *Department*; and
- b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or well field, superintendent, or position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the *covered entity* (a duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- c. The written authorization shall include the name, title and signature of the authorized representative and be attached to the MCC form; and
- d. **Changes to authorization.** If an authorization to discharge is no longer accurate because a different *covered entity* has responsibility for the overall operation of another *covered entity's* program, these changes must be indicated on the MCC form submitted to the *Department* per Part V.D.
- e. **Initial signatory authorization or changes to signatory authorization.** The initial signatory authorization must be submitted to the *Department* with any reports to be signed by a signatory representative. If a signatory authorization under VI.J.2 is no longer accurate because a different individual, or position, has responsibility for the overall operation of the facility, a new signatory authorization satisfying the requirements of VI.J.2 must be submitted to the *Department* with any reports to be signed by an authorized representative.
- f. **Certification.** Any person signing documents under paragraph VI.H shall make the following certification:

"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

⁴Positions that must be duly authorized include, but are not limited to, Environmental Directors, Deputy Supervisors, Safety and Environmental Managers, Assistant Directors, and Chief Health and Safety Officers.

(Part VI.J.2.f.)

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."

Under Part VI.J. (Signatory Requirements), it shall constitute a permit violation if an incorrect and/or improper signatory authorizes any required forms, and/or reports.

K. Penalties for Falsification of Reports

Article 17 of the *ECL* provides a civil penalty of \$37,500 per day per violation of this permit. Articles 175 and 210 of the New York State Penal Law provide for a criminal penalty of a fine and / or imprisonment for falsifying reports required under this permit..

L. Oil and Hazardous Substance Liability

Nothing in this *SPDES general permit* shall be construed to preclude the institution of any legal action or relieve the *covered entity* from any responsibilities, liabilities, or penalties to which it is or may be subject under section 311 of the CWA or section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

M. Property Rights

The issuance of this *SPDES general permit* does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations, nor does it limit, diminish and / or stay compliance with any terms of this permit.

N. Severability

The provisions of this *SPDES general permit* are severable, and if any provision of this *SPDES general permit*, or the application of any provision of this *SPDES general permit* to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

O. Requiring an Individual Permit or an Alternative General Permit

1. In its sole discretion, the *Department* may require any person authorized by this *SPDES general permit* to apply for and/or obtain either an *individual SPDES permit* or an alternative *SPDES general permit*. Where the *Department* requires a *covered entity* to apply for an *individual SPDES permit*, the *Department* will notify such

(Part VI.O.1.)

person in writing that a permit application is required. This notification shall include a brief statement of the reasons for this decision, an application form, a statement setting a deadline for filing the application, and a deadline not sooner than 180 days from covered entity's receipt of the notification letter, whereby the authorization to discharge under this general permit shall be terminated. Applications must be submitted to the appropriate Regional Office. The *Department* may grant additional time to submit the application upon request of the applicant.

2. Any *covered entity* authorized by this *SPDES general permit* may request to be excluded from the coverage of this *SPDES general permit* by applying for an *individual SPDES permit* or an *alternative SPDES general permit*. In such cases, a *covered entity* must submit an individual application or an application for an alternative *SPDES general permit* in accordance with the requirements of 40 CFR 122.26(c)(1)(ii), with reasons supporting the request, to the *Department* at the address for the appropriate Regional Office. The request may be granted by issuance of any *individual SPDES permit* or an *alternative SPDES general permit* if the reasons cited by the *covered entity* are adequate to support the request.
3. When an individual *SPDES permit* is issued to a discharger authorized to discharge under a *SPDES general permit* for the same discharge(s), the general permit authorization for outfalls authorized under the individual permit is automatically terminated on the effective date of the individual permit unless termination is earlier in accordance with 6 NYCRR Part 750.

P. Other State Environmental Laws

1. Nothing in this *SPDES general permit* shall be construed to preclude the institution of any legal action or relieve a *covered entity* from any responsibilities, liabilities, or penalties established pursuant to any applicable *State* law or regulation under authority preserved by section 510 of the CWA.
2. No condition of this *SPDES general permit* releases the *covered entity* from any responsibility or requirements under other environmental statutes or regulations.

Q. Proper Operation and Maintenance

A *covered entity* must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the *covered entity* to achieve compliance with the conditions of this *SPDES general permit*. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems,

(Part VI.Q.)

installed by a *covered entity* only when necessary to achieve compliance with the conditions of the *SPDES general permit*.

R. Inspection and Entry

The *covered entity* shall allow the Commissioner of NYSDEC, the Regional Administrator of the USEPA, the applicable county health department, or their authorized representatives, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the *covered entity's* premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this *SPDES general permit*;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit, including records required to be maintained for purposes of operation and maintenance; and
3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment), practices, or operations regulated or required under the permit.

S. Permit Actions

At the *Department's* sole discretion, this *SPDES general permit* may be modified, revoked, suspended, or renewed for cause at any time.

T. Anticipated noncompliance

The *covered entity* shall give advance notice to the *Department* of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. Notification of planned changes or anticipated noncompliance does not limit, diminish and / or stay compliance with any terms of this permit.

U. Permit Transfers.

Coverage under this *SPDES general permit* is not transferable to any person except after notice to the *Department*. The *Department* may require modification or revocation and reissuance of this *SPDES general permit* to change the responsible party and incorporate such other requirements as may be necessary.

Part VII. MINIMUM CONTROL MEASURES - TRADITIONAL LAND USE CONTROL

A. Traditional Land-Use Control MS4 Minimum Control Measures (MCMs)

These MCMs apply to *traditional land use control MS4s* (cities, towns, villages). The SWMP for these *small MS4s* must be comprised of the 6 MCMs below. It is recommended that covered entities refer to assistance and guidance documents available from the *State* and EPA.

Continuing covered entities were required to develop a SWMP with the MCM requirements below by January 8, 2008 (if authorized by GP-02-02) and within three years of gaining coverage (if authorized by GP-0-10-002). Under this *SPDES general permit*, the continuing *covered entities* are required to implement their SWMP, including the MCM requirements below. Notwithstanding any sooner deadlines contained elsewhere within this permit, newly regulated *covered entities* are required to develop their SWMP, containing the MCM requirements below, within the first 3 years of coverage and then commence implementation.

For each of the elements of the SWMP plan, the *covered entity* must identify (i) the agencies and/or offices that would be responsible for implementing the SWMP plan element and (ii) any protocols for coordination among such agencies and/or offices necessary for the implementation of the plan element.

The *covered entity* may *develop* (for newly authorized MS4s) and /or *implement* their SWMP within their jurisdiction on their own. The *covered entity* may also *develop* (for newly authorized MS4s) and / or *implement* part or all of their SWMP through an intermunicipal program with another *covered entity(s)* or through other cooperative or contractual agreements with third parties that provide services to the *covered entities*.

1. Public Education and Outreach - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. Identify *POCs*, waterbodies of concern, geographic areas of concern, target audiences;
- b. *Develop* (for newly authorized MS4s) and *implement* an ongoing public education and outreach program designed to describe to the general public and target audiences:
 - i. the impacts of *stormwater discharges* on waterbodies;
 - ii. *POCs* and their sources;
 - iii. steps that contributors of these pollutants can take to reduce pollutants in *stormwater runoff*; and

(Part VII.A.1.b.)

- iv. steps that contributors of non-*stormwater discharges* can take to reduce pollutants (non-*stormwater discharges* are listed in Part I.A.2);
- c. *Develop (for newly authorized MS4s), record, periodically assess, and modify as needed, measurable goals;* and
- d. Select and implement appropriate education and outreach *activities* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- e. **Program *implementation* reporting for continuing *covered entities*** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. list education / outreach *activities* performed for the general public and target audiences and provide any results (for example, number of people attended, amount of materials distributed, etc.);
 - ii. *covered entities* performing the education and outreach activities required by other MCMs (listed below), may report on those activities in MCM 1 and provide the following information applicable to their program:
 - IDDE education *activities* planned or completed for public employees, businesses, and the general public, as required by Part VII.A.3;
 - construction site *stormwater* control training planned or completed, as required by Part VII.A.4; and
 - employee pollution prevention / good housekeeping training planned or completed, as required by Part VII.A.6; andTo facilitate shared annual reporting, if the education and outreach activities above are implemented by a third party, and the third party is completing the associated portions of the annual report, that third party may report on the education and outreach activities within MCM 1 of the annual report and not within the MCMs that the education and outreach activities are required by,
 - iii. report on effectiveness of program, *BMP* and *measurable goal* assessment; and
 - iv. maintain records of all training activities.
- f. Reporting for **newly regulated *covered entities*** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. **program *development* deadlines and reporting:**

(Part VII.A.1.f.i.)

Complete in Year 1 (report changes in Year 2 and 3 as needed):

- list (and describe if necessary) *POCs*;
- *development* of education and outreach program and *activities* for the general public and target or priority audiences that address *POCs*, geographic areas of concern, and / or *discharges to 303(d) / TMDL* waterbodies;
- *covered entities* developing education and outreach programs required by other MCMs (listed below), may report on development (and implementation of those activities, if occurring during the three year development period) in MCM 1 and provide the following information applicable to their program:
 - IDDE education *activities* planned or completed for public employees, businesses, and the general public for IDDE, as required by Part VII.A.3;
 - Construction site stormwater control training planned or completed, as required by Part VII.A.4; and
 - employee pollution prevention / good housekeeping training planned or completed, as required by Part VII.A.6;

To facilitate shared annual reporting, if the education and outreach activities above are developed by a third party, and the third party is completing the associated portions of the annual report, that third party may report on the education and outreach activities within MCM 1 of the annual report and not within the MCMs that the education and outreach activities are required by.

ii. **program implementation reporting** as set forth in Part VII.A.1(e) above. Commence *implementation* reporting after three year *development* period. *Implementation* reporting may begin earlier if *implementation* begins during *development* period.

2. Public Involvement / Participation - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. Comply with the *State Open Meetings Law* and local public notice requirements, such as *Open Meetings Law*, when implementing a public involvement / participation program;
- b. *Develop (for newly authorized MS4s)* and *implement* a public involvement/participation program that:
 - i. identifies key individuals and groups, public and private, who are interested in or affected by the *SWMP* ;

(Part VII.A.2.b.)

- ii. identifies types of input the *covered entity* will seek from the key individuals and groups, public and private, to support *development* and *implementation* of the SWMP program and how the input will be used; and
 - iii. describes the public involvement / participation activities the *covered entity* will undertake to provide program access to those who want it and to gather the needed input. The activities included, but are not limited to a water quality hotline (report spills, dumping, construction sites of concern, etc.), stewardship activities like stream cleanups, storm drain marking, and volunteer water quality monitoring;
 - iv. provide the opportunity for the public to participate in the *development, implementation, review, and revision* of the *SWMP*.
- c. **Local stormwater public contact.**
Identify a local point of contact for public concerns regarding *stormwater* management and compliance with this *SPDES general permit*. The name or title of this contact and the telephone number must be published in public outreach and public participation materials and kept updated with the *Department* on the MCC form;
- d. **Annual report presentation.**
Below are the requirements for the annual report presentation:
- i. prior to submitting the final annual report to the *Department*, by June 1 of each reporting year (see Part V.C.), present the draft annual report in a format that is open to the public, where the public can ask questions about and make comments on the report. This can be done:
 - at a meeting that is open to the public, where the public attendees are able to ask questions about and make comments on the report. This may be a regular meeting of an existing board, such as planning, zoning or the town board. It may also be a separate meeting, specifically for *stormwater*. If multiple *covered entities* are working together, they may have a group meeting (refer to Part V.C.2); or
 - on the internet by:
 - making the annual report available to the public on a website;
 - providing the public the opportunity to provide comments on the internet or otherwise; and

(Part VII.A.2.d.i.)

- making available the opportunity for the public to request an open meeting to ask questions about and make comments on the report. If a public meeting is requested by 2 or more persons, the covered entity must hold such a meeting. However, the covered entity need only hold a public meeting once to satisfy this requirement.
- ii. provide public notice about the presentation, making public the following information when noticing the presentation in accordance with the local public notice requirements:
 - the placement of the annual report on the agenda of this meeting or location on the internet;
 - the opportunity for public comment. This *SPDES general permit* does not require a specified time frame for public comments, although it is recommended that *covered entities* do provide the public an opportunity to comment for a period after the meeting. Comments received after the final annual report is submitted shall be reported with the following year's annual report. *Covered entities* must take into account those comments in the following year;
 - the date and time of the meeting or the date the annual report becomes available on the internet; and
 - the availability of the draft report for prior review prior to the public meeting or duration of availability of annual report on the internet;
- iii. the *Department* recommends that announcements be sent directly to individuals (public and private) known to have a specific interest in the *covered entity's SWMP*;
- iv. include a summary of comments and (intended) responses with the final annual report. Changes made to the *SWMP* in response to comments should be described in the annual report; and
- v. ensure that a copy of the final report and, beginning in 2009, the *SWMP* plan are available for public inspection;
- e. *Develop (for newly authorized MS4s), record, periodically assess and modify as needed measurable goals; and*

(Part VII.A.2.)

- f. Select and implement appropriate public involvement / participation *activities* and *measurable goals* to ensure the reduction of *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- g. **Program *implementation* reporting for continuing covered entities** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. annual report presentation information (date, time, attendees) or information about how the annual report was made available for comment;
 - ii. comments received and intended responses (as an attachment);
 - iii. public involvement / participation *activities* (for example stream cleanups including the number of people participating, the number of calls to a water quality hotline, the number and extent of storm drain stenciling); and
 - iv. report on effectiveness of program, *BMP* and *measurable goal* assessment.
- h. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. **program *development* deadlines and reporting:**
 - Complete for Year 1, 2 and 3:
 - annual report presentation information (date, time, attendees);
 - comments received and intended responses (as an attachment);
 - Complete by end of Year 2 (report changes by end of Year 3 as needed):
 - key stake holders identified;
 - *development* of public involvement / participation plan based on the *covered entity's* needs, *POCs*, target audiences, geographic areas of concern, *discharges* to *303(d)* / *TMDL* waterbodies; and
 - *development* of public involvement / participation *activities* (for example stream cleanups including the number of people participating, the number of calls to a dumping / water quality hotline, the number or percent of storm drains stenciled);
 - ii. **program *implementation* reporting**, as set forth in Part VII.A.2(g) above. Commence *implementation* reporting after three year *development* period. *Implementation* reporting may begin earlier if *implementation* begins during development period.

(Part VII.A.)

3. Illicit Discharge Detection and Elimination (IDDE) - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. *Develop (for newly authorized MS4s), implement and enforce a program to detect and eliminate illicit discharges (as defined at 40CFR 122.26(b)(2)) into the small MS4;*
- b. *Develop (for newly authorized MS4s) and maintain a map, at a minimum within the covered entity's jurisdiction in the urbanized area and additionally designated area, showing:*
 - i. *the location of all outfalls and the names and location of all surface waters of the State that receive discharges from those outfalls;*
 - ii. *by March 9, 2010, the preliminary boundaries of the covered entity's storm sewersheds have been determined using GIS or other tools, even if they extend outside of the urbanized area (to facilitate track down), and additionally designated area within the covered entity's jurisdiction; and*
 - iii. *when grant funds are made available or for sewer lines surveyed during an illicit discharge track down, the covered entity's storm sewer system in accordance with available State and EPA guidance;*
- c. *Field verify outfall locations;*
- d. *Conduct an outfall reconnaissance inventory, as described in the EPA publication entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment, addressing every outfall within the urbanized area and additionally designated area within the covered entity's jurisdiction at least once every five years, with reasonable progress each year;*
- e. *Map new outfalls as they are constructed or newly discovered within the urbanized area and additionally designated area;*
- f. *Prohibit, through a law, ordinance, or other regulatory mechanism, illicit discharges into the small MS4 and implement appropriate enforcement procedures and actions. This mechanism must be equivalent to the State's model IDDE local law "NYSDEC Model Local Law to Prohibit Illicit Discharges, Activities and Connections to Separate Storm Sewer Systems". The mechanism must be certified by the attorney representing the small MS4 as being equivalent to the State's model illicit discharge local law. Laws adopted during the GP-02-02 permit cycle must also be attorney-certified as effectively assuring implementation of the State's model IDDE law;*

(Part VII.A.3.)

- g. *Develop (for newly authorized MS4s) and implement* a program to detect and address non-stormwater *discharges*, including illegal dumping, to the *small MS4* in accordance with current assistance and guidance documents from the State and EPA. The program must include: procedures for identifying priority areas of concern (geographic, audiences, or otherwise) for the IDDE program; description of priority areas of concern, available equipment, staff, funding, etc.; procedures for identifying and locating *illicit discharges* (trackdown); procedures for eliminating *illicit discharges*; and procedures for documenting actions;
- h. Inform public employees, businesses, and the general public of the hazards associated with illegal *discharges* and improper disposal of waste, and maintain records of notifications;
- i. Address the categories of non-stormwater *discharges* or flows listed in Part I.A.2 as necessary;
- j. *Develop (for newly authorized MS4s)*, record, periodically assess, and modify as needed, *measurable goals*; and
- k. Select and implement appropriate IDDE *BMPs* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- l. **Program *implementation* reporting for continuing covered entities** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. number and percent of *outfalls* mapped;
 - ii. number of *illicit discharges* detected and eliminated;
 - iii. percent of outfalls for which an outfall reconnaissance inventory has been performed. ;
 - iv. status of system mapping;
 - v. activities in and results from informing public employees, businesses, and the general public of hazards associated with illegal *discharges* and improper disposal of waste;
 - vi. regulatory mechanism status - certification that law is equivalent to the *State's* model IDDE law (if not already completed and submitted with an earlier annual report); and
 - vii. report on effectiveness of program, *BMP* and *measurable goal* assessment.

(Part VII.A.3.)

m. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:

i. **program development deadlines and reporting:**

Complete in Year 1 (revise in Year 2 and 3 if changes are made):

- describe procedures for identifying priority areas of concern (geographic, audiences, or otherwise) for IDDE program;
 - describe priority areas of concern, available equipment, staff, funding, etc.;
- Initiate by end of Year 1; complete by end of Year 2 (revise in Year 3 if changes are made):

- describe procedures for identifying and locating *illicit discharges* (trackdown);
- describe procedures for eliminating *illicit discharges*;
- describe procedures for enforcing against illicit dischargers;
- describe procedures for documenting actions;
- describe the program being developed for informing public employees, businesses, and the general public of hazards associated with illegal *discharges* and improper disposal of waste;

Initiate by end of Year 1; complete by end of Year 3:

- regulatory mechanism status development and adoption - by end of Year 3 certify that regulatory mechanism is equivalent to the *State's* model IDDE law (if not already completed and submitted with an earlier report);

Initiate by end of Year 2; complete by end of Year 3:

- number and percent of *outfalls* mapped; and

Complete by Year 3:

- *outfall* map.

ii. **program implementation reporting** as set forth in Part VIII.A.3(l) above.

Commence *implementation* reporting after three year *development* period.

Implementation reporting may begin earlier if *implementation* begins during development period.

4. Construction Site Stormwater Runoff Control - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. *Develop* (for newly authorized MS4s), *implement*, and enforce a program that:

(Part VII.A.4.a.)

- i. provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from Construction Activities (either GP-02-01, GP-0-08-001 or GP-0-15-002), unless more stringent requirements are contained within this *SPDES general permit*;
- ii. addresses *stormwater* runoff to the *small MS4* from *construction activities* that result in a land disturbance of greater than or equal to one acre. Control of *stormwater discharges* from *construction activity* disturbing less than one acre must be included in the program if:
 - that *construction activity* is part of a *larger common plan of development or sale* that would disturb one acre or more; or
 - if controlling such activities in a particular watershed is required by the *Department*;
- iii. includes a law, ordinance or other regulatory mechanism to require a *SWPPP* for each applicable land disturbing activity that includes erosion and sediment controls that meet the *State* 's most current technical standards:
 - this mechanism must be equivalent to one of the versions of the "NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control"; and
 - equivalence must be documented
 - by adoption of one of the sample local laws without changes;
 - by using the NYSDEC Gap Analysis Workbook; or
 - by adoption of a modified version of the sample law, or an alternative law, and, in either scenario, certification by the attorney representing the small MS4 that the adopted law is equivalent to one of the sample local laws.
- iv. contains requirements for construction site operators to implement erosion and sediment control management practices;
- v. allows for sanctions to ensure compliance to the extent allowable by State law;
- vi. contains requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality, pursuant to the requirement of construction permit;
- vii. describes procedures for *SWPPP* review with consideration of potential water quality impacts and review of individual *SWPPPs* to ensure consistency with *State* and local sediment and erosion control requirements;

(Part VII.A.4.a.vii.)

- ensure that the individuals performing the reviews are adequately trained and understand the *State* and local sediment and erosion control requirements;
 - all *SWPPPs* must be reviewed for sites where the disturbance is one acre or greater; and
 - after review of *SWPPPs*, the *covered entity* must utilize the "MS4 *SWPPP* Acceptance Form" created by the *Department* and required by the SPDES General Permit for Stormwater Discharges from Construction Activity when notifying construction site owner / operators that their plans have been accepted by the *covered entity*;
- viii. describes procedures for receipt and follow up on complaints or other information submitted by the public regarding construction site storm water runoff;
- ix. describes procedures for site inspections and enforcement of erosion and sediment control measures including steps to identify priority sites for inspection and enforcement based on the nature of the construction activity, topography, and the characteristics of soils and receiving water;
- the *covered entity* must ensure that the individual(s) performing the inspections are adequately trained and understand the *State* and local sediment and erosion control requirements. Adequately trained means receiving inspector training by a *Department* sponsored or approved training;
 - all sites must be inspected where the disturbance is one acre or greater;
 - *covered entities* must determine that it is acceptable for the owner or operator of a construction project to submit the Notice of Termination (NOT) to the *Department* by performing a final site inspection themselves or by accepting the Qualified Inspector's final inspection certification(s) required by the SPDES General Permit for Stormwater Discharges from Construction Activity. The principal executive officer, ranking elected official, or duly authorized representative (see Part VI.J.) shall document their determination by signing the "MS4 Acceptance" statement on the NOT.
- x. educates construction site owner / operators, design engineers, *municipal* staff and other individuals to whom these regulations apply about the *municipality's* construction *stormwater* requirements, when construction *stormwater* requirements apply, to whom they apply, the procedures for submission of *SWPPPs*, construction site inspections, and other procedures associated with control of construction stormwater;

(Part VII.A.4.a.)

- xi. ensures that construction site operators have received erosion and sediment control training before they do work within the *covered entity's* jurisdiction and maintain records of that training. Small home site construction (construction where the Erosion and Sediment Control Plan is developed in accordance with Appendix E of the "New York Standards and Specifications for Erosion and Sediment Control") is exempt from the requirements below:
 - training may be provided by the *Department* or other qualified entities (such as Soil and Water Conservation Districts);
 - the *covered entity* is not expected to perform such training, but they may co-sponsor training for construction site operators in their area;
 - the *covered entity* may ask for a certificate of completion or other such proof of training; and
 - the *covered entity* may provide notice of upcoming sediment and erosion control training by posting in the building department or distribute with building permit application;
- xii. establishes and maintains an inventory of active construction sites, including the location of the site, owner / operator contact information;
- xiii. *develop (for newly authorized MS4s), record, periodically assess and modify as needed measurable goals; and*
- xiv. select and appropriate construction *stormwater BMPs and measurable goals* to ensure the reduction of all *POCs in stormwater discharges* to the *MEP*.

Required SWMP Reporting

- b. **Program *implementation* reporting for continuing *covered entities*** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. number of *SWPPPs* reviewed;
 - ii. number and type of enforcement actions;
 - iii. percent of active construction sites inspected once;
 - iv. percent of active construction sites inspected more than once;
 - v. number of construction sites authorized for disturbances of one acre or more; and
 - vi. report on effectiveness of program, *BMP* and *measurable goal* assessment.
- c. Reporting for **newly regulated *covered entities*** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:

(Part VII.A.4.c.)

i. program *development* deadlines and reporting:

Initiate by end of Year 1:

- procedures, activities and identify personnel to educate and train construction site operators about requirements to develop and implement a SWPPP and any other requirements that must be met within the MS4's jurisdiction;

Complete in Year 1 (revise in Year 2 and 3 if changes are made):

- describe procedures for the receipt and consideration of information submitted by the public. Identify the responsible personnel;

Initiate by end of Year 1; complete by end of Year 3:

- regulatory mechanism development and adoption status - by end of Year 3 certify that regulatory mechanism is equivalent to one of the NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control (if not already completed and submitted with an earlier report);

Initiate by end of Year 2; complete by end of Year 3:

- describe procedures for SWPPP review that incorporate consideration of potential water quality impacts and ensure consistency with local sediment and erosion control requirements;
- describe procedures for construction site inspections; and
- describe procedures for enforcement of control measures and sanctions to ensure compliance.

ii. program *implementation* reporting as set forth in Part VII.A.4(b) above.

Commence *implementation* reporting after three year *development* period.

Implementation reporting may begin earlier if *implementation* begins during development period.

5. Post-Construction Stormwater Management - SWMP Development/Implementation

At a minimum, all *covered entities* must:

a. *Develop (for newly authorized MS4s), implement, and enforce* a program that:

- provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from Construction Activities (either GP-02-01, GP-0-08-001, or GP-0-15-002), unless more stringent requirements are contained within this *SPDES general permit*;
- addresses *stormwater* runoff from new development and redevelopment projects to the *small MS4* from projects that result in a land disturbance of greater than or

(Part VII.A.5.a.ii.)

equal to one acre. Control of *stormwater discharges* from projects of less than one acre must be included in the program if:

- that project is part of a *larger common plan of development or sale*; or
- if controlling such activities in a particular watershed is required by the *Department*;

iii. includes a law, ordinance or other regulatory mechanism to require post construction runoff controls from new development and re-development projects to the extent allowable under *State* law that meet the *State's* most current technical standards:

- the mechanism must be equivalent to one of the versions of the "NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control"; and
- equivalence must be documented
 - by adoption of one of the sample local laws without changes;
 - by using the NYSDEC Gap Analysis Workbook; or
 - by adoption of a modified version of the sample law, or an alternative law, and, in either scenario and certification by the attorney representing the small MS4 that the adopted law is equivalent to one of the sample local laws;

iv. includes a combination of structural or non-structural management practices (according to standards defined in the most current version of the NYS Stormwater management Design Manual) that will reduce the *discharge* of pollutants to the MEP. In the development of the watershed plans, municipal comprehensive plans, open space preservation programs, local law, ordinances and land use regulations, covered entities must consider principles of *Low Impact Development* (LID), *Better Site Design* (BSD), and other *Green Infrastructure* practices to the MEP. In the development of the watershed plans, municipal comprehensive plans, open space preservation programs, local law, ordinances and land use regulations, covered entities must consider smart growth principles, natural resource protection, impervious area reduction, maintaining natural hydrologic conditions in developments, riparian buffers or set back distances for protection of environmentally sensitive areas such as streams, wetlands, and erodible soils.

- *covered entities* are required to review according to the *Green Infrastructure* practices defined in the Design Manual at a site level, and are encouraged to review, and revise where appropriate, local codes and laws that include provisions that preclude green infrastructure or construction techniques that minimize or reduce pollutant loadings.

(Part VII.A.5.a.iv.)

- if a *stormwater* management practice is designed and installed in accordance with the New York State Stormwater Management Design Manual or has been demonstrated to be equivalent and is properly operated and maintained, then *MEP* will be assumed to be met for post-construction *stormwater* discharged by the practice;
- v. describes procedures for *SWPPP* review with consideration of potential water quality impacts and review of individual *SWPPPs* to ensure consistency with state and local post-construction *stormwater* requirements;
 - ensure that the individuals performing the reviews are adequately trained and understand the *State* and local post construction *stormwater* requirements;
 - ensure that the individuals performing the reviews for *SWPPPs* that include post-construction stormwater management practices are *qualified professionals* or under the supervision of a *qualified professional*;
 - all *SWPPPs* must be reviewed for sites where the disturbance is one acre or greater;
 - after review of *SWPPPs*, the *covered entity* must utilize the “MS4 *SWPPP* Acceptance Form” created by the *Department* and required by the SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-15-002) when notifying construction site owner / operators that their plans have been accepted by the *covered entity*;
 - utilize available training from sources such as Soil and Water Conservation Districts, Planning Councils, The New York State Department of State, USEPA, and/or the *Department* to educate municipal boards and Planning and Zoning Boards on low impact development principles, better site design approach, and green infrastructure applications.
- vi. maintain an inventory of post-construction stormwater management practices within the *covered entities* jurisdiction. At a minimum, include practices discharging to the *small MS4* that have been installed since March 10, 2003, all practices owned by the *small MS4*, and those practices found to cause or contribute to water quality standard violations.
 - the inventory shall include at a minimum: location of practice (street address or coordinates); type of practice; maintenance needed per the NYS Stormwater Management Design Manual, *SWPPP*, or other provided documentation; and dates and type of maintenance performed; and

(Part VII.A.5.a.)

- vii. ensures adequate long-term operation and maintenance of management practices identified in Part VII.5.a.vi by trained staff, including inspection to ensure that practices are performing properly.
 - The inspection shall include inspection items identified in the maintenance requirements (NYS Stormwater Management Design Manual, *SWPPP*, or other maintenance information) for the practice. *Covered entities* are not required to collect *stormwater* samples and perform specific chemical analysis;
- viii. Covered entities may include in the SWMP Plan provisions for development of a banking and credit system. MS4s must have an existing watershed plan based on which offsite alternative stormwater management in lieu of or in addition to on-site stormwater management practices are evaluated. Redevelopment projects must be evaluated for pollutant reduction greater than required treatment by the state standards. The individual project must be reviewed and approved by the *Department*. Use of a banking and credit system for new development is only acceptable in the impaired watersheds to achieve the no net increase requirement and watershed improvement strategy areas to achieve pollutant reductions in accordance with watershed plan load reduction goals. A banking and credit system must at minimum include:
 - Ensure that offset exceeds a standard reduction by factor of at least 2
 - Offset is implemented within the same watershed
 - Proposed offset addresses the POC of the watershed
 - Tracking system is established for the watershed
 - Mitigation is applied for retrofit or redevelopment
 - Offset project is completed prior to beginning of the proposed construction
 - A legal mechanism is established to implement the banking and credit system
- b. *Develop (for newly authorized MS4s), implement, and provide adequate resources for a program to inspect development and re-development sites by trained staff and to enforce and penalize violators;*
- c. *Develop (for newly authorized MS4s), record, annually assess and modify as needed measurable goals; and*
- d. Select and implement appropriate post-construction *stormwater BMPs* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.

(Part VII.A.5.)

Required SWMP Reporting

- e. **Program *implementation* reporting for continuing covered entities** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. number of *SWPPPs* reviewed;
 - ii. number and type of enforcement actions;
 - iii. number and type of post-construction stormwater management practices inventoried;
 - iv. number and type of post-construction stormwater management practices inspected;
 - v. number and type of post-construction stormwater management practices maintained;
 - vi. regulatory mechanism status - certification that regulatory mechanism is equivalent to one of the “NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control” (if not already done); and
 - vii. report on effectiveness of program, BMP and measurable goal assessment, and implementation of a banking and credit system, if applicable;

- f. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. **program *development* deadlines and reporting:**
 - Initiate by end of Year 1; complete by end of Year 3:
 - regulatory mechanism development and adoption status - by end of Year 3 certify that regulatory mechanism is equivalent to one of the NYSDEC Sample Local Laws for Stormwater Management and Erosion and Sediment Control (if not already completed and submitted with an earlier report);

 - Initiate by end of Year 2; complete by end of Year 3:
 - procedures for *SWPPP* review to ensure that post-construction stormwater management practices meet the most current version of the state technical standards;
 - procedures for inspection and maintenance of post-construction management practices;
 - procedures for enforcement and penalization of violators; and

 - Complete by the end of year 3:

(Part VII.A.5.f.i.)

- provide resources for the program to inspect new and re-development sites and for the enforcement and penalization of violators.
- ii. **program *implementation* reporting** as set forth in Part VII.A.5(e) above. Commence *implementation* reporting after three year *development* period. *Implementation* reporting may begin earlier if *implementation* begins during *development* period.

6. Pollution Prevention/Good Housekeeping For Municipal Operations - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. *Develop (for newly authorized MS4s) and implement* a pollution prevention / good housekeeping program for *municipal* operations and facilities that:
 - i. addresses *municipal* operations and facilities that contribute or potentially contribute *POCs* to the *small MS4* system. The operations and facilities may include, but are not limited to: street and bridge maintenance; winter road maintenance; stormwater system maintenance; vehicle and fleet maintenance; park and open space maintenance; municipal building maintenance; solid waste management; new construction and land disturbances; right-of-way maintenance; marine operations; hydrologic habitat modification; or other;
 - ii. at a minimum frequency of once every three years, perform and document a self assessment of all municipal operations addressed by the SWMP to:
 - determine the sources of pollutants potentially generated by the *covered entity's* operations and facilities; and
 - identify the *municipal* operations and facilities that will be addressed by the pollution prevention and good housekeeping program, if it is not done already;
 - iii. determines *management practices*, policies, procedures, etc. that will be *developed* and *implemented* to reduce or prevent the discharge of (potential) pollutants. Refer to management practices identified in the “NYS Pollution Prevention and Good Housekeeping Assistance Document” and other guidance materials available from the EPA, *State*, or other organizations;
 - iv. prioritizes pollution prevention and good housekeeping efforts based on geographic area, potential to improve water quality, facilities or operations most in need of modification or improvement, and *covered entity's* capabilities;

(Part VII.A.6.a.)

- v. addresses pollution prevention and good housekeeping priorities;
 - vi. includes an employee pollution prevention and good housekeeping training program and ensures that staff receive and utilize training;
 - vii. requires third party entities performing contracted services, including but not limited to street sweeping, snow removal, lawn / grounds care, etc., to meet permit requirements as the requirements apply to the activity performed ; and
 - viii. requires *municipal* operations and facilities that would otherwise be subject to the NYS Multi-sector General Permit (MSGP, GP-0-12-001) for industrial stormwater discharges to prepare and *implement* provisions in the SWMP that comply with Parts III. A, C, D, J, K and L of the MSGP. The covered entity must also perform monitoring and record keeping in accordance with Part IV. of the MSGP. Discharge monitoring reports must be attached to the MS4 annual report. Those operations or facilities are not required to gain coverage under the MSGP. *Implementation* of the above noted provisions of the SWMP will ensure that MEP is met for discharges from those facilities;
- b. Consider and incorporate cost effective runoff reduction techniques and green infrastructure in the routine upgrade of the existing stormwater conveyance systems and municipal properties to the MEP. Some examples include replacement of closed drainage with grass swales, replacement of existing islands in parking lots with rain gardens, or curb cuts to route the flow through below grade infiltration areas or other low cost improvements that provide runoff treatment or reduction.
 - c. *Develop (for newly authorized MS4s), record, periodically assess and modify as needed measurable goals; and*
 - d. Select and implement appropriate pollution prevention and good housekeeping *BMPs and measurable goals* to ensure the reduction of all *POCs in stormwater discharges* to the *MEP*.
 - e. Adopt techniques to reduce the use of fertilizers, pesticides, and herbicides, as well as potential impact to surface water.

Required SWMP Reporting

- f. **Program *implementation* reporting for continuing covered entities** (MS4s covered for 3 or more years on the *reporting date*). *Covered entities* are required to report on

(Part VII.A.6.f.)

all *municipal* operations and facilities within their jurisdiction (*urbanized area* and *additionally designated area*) that their program is addressing. The *covered entity* shall report at a minimum on the items below:

- i. indicate the *municipal* operations and facilities that the pollution prevention and good housekeeping program assessed;
 - ii. describe, if not done so already, the management practices, policies and procedures that have been developed, modified, and / or implemented and report, at a minimum, on the items below that the *covered entity's* pollution prevention and good housekeeping program addressed during the reporting year:
 - acres of parking lot swept;
 - miles of street swept;
 - number of catch basins inspected and, where necessary, cleaned;
 - post-construction control stormwater management practices inspected and, where necessary, cleaned;
 - pounds of phosphorus applied in chemical fertilizer
 - pounds of nitrogen applied in chemical fertilizer; and
 - acres of pesticides / herbicides applied.
 - iii. staff training events and number of staff trained; and
 - iv. report on effectiveness of program, *BMP* and *measurable goal* assessment. If the pollution prevention and good housekeeping program addresses other operations than what is listed above in Part VII.A.6.a(ii), the *covered entity* shall report on items that will demonstrate program effectiveness.
- g. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). *Covered entities* are required to report on all *municipal* operations and facilities within their jurisdiction (*urbanized area* and *additionally designated area*) that their program is addressing. The *covered entity* shall report at a minimum on the items below:
- i. **program development deadlines and reporting** (first three years after authorization is granted):
Complete by end of Year 1:
 - identify the municipal operations and facilities that will be considered for inclusion in the pollution prevention and good housekeeping program;
 - describe the pollution prevention and good housekeeping program priorities (geographic area, potential to improve water quality; facilities or operations most in need of modification or improvement);

(Part VII.A.6.g.i.)

- describe management practices, policies, procedures, etc. that will be developed or modified;
- identify the staff and equipment available;

Initiate by end of Year 2; complete by end of Year 3:

- describe employee pollution prevention and good housekeeping program training program and begin training, report on number of staff trained; and

Complete by end of Year 3:

- description of developed management practices.

- ii. **program *implementation* reporting** as set forth in Part VII.A.6.(d) above. Commence reporting after three year *development* permit. *Implementation* reporting may begin earlier if *implementation* begins during development period.

PART VIII. MINIMUM CONTROL MEASURES - TRADITIONAL NON-LAND USE CONTROL AND NON-TRADITIONAL MS4s

A. Traditional Non-Land Use Control and Non-traditional MS4 Minimum Control Measures (MCMs)

These MCMs apply to *traditional non-land use control MS4s* and *non-traditional MS4s*. The SWMP for these *small MS4s* must be comprised of the 6 MCMs below. It is recommended that covered entities refer to assistance and guidance documents available from the *State* and EPA.

Under this *SPDES general permit*, the continuing *covered entities* are required to implement their SWMP, including the MCM requirements below. Newly regulated covered entities are required to develop their SWMP, containing the MCM requirements below, within the first 3 years of coverage and then commence implementation.

The *covered entity* may *develop (for newly authorized MS4s)* and / or *implement* their SWMP within their jurisdiction on their own. The *covered entity* may also *develop (for newly authorized MS4s)* and / or *implement* part or all of their SWMP through an intermunicipal program with another *covered entity(s)* or through other cooperative or contractual agreements with third parties that provide services to the *covered entity(s)*.

For each of the elements of the SWMP plan, the *covered entity* must identify (i) the agencies and/or offices that would be responsible for implementing the SWMP plan element and (ii) any protocols for coordination among such agencies and/or offices necessary for the implementation of the plan element.

To comply with the requirements of this *SPDES general permit*, the *traditional non-land use control MS4s* and *non-traditional MS4s* should consider their public to be the employee / user population, visitors, or contractors / developers. Examples of the public include, but are not limited to:

- transportation *covered entities* - general public using or living along transportation systems, staff, contractors;
- educational *covered entities* - faculty, other staff, students, visitors;
- other government *covered entities* - staff, contractors, visitors.

1. Public Education and Outreach on Stormwater Impacts SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. Identify *POCs*, waterbodies of concern, geographic areas of concern, target audiences;

(Part VIII.A.1.)

- b. *Develop (for newly authorized MS4s) and implement* an ongoing public education and outreach program designed to describe:
 - i. the impacts of *stormwater discharges* on waterbodies;
 - ii. *POCs* and their sources;
 - iii. steps that contributors of these pollutants can take to reduce pollutants in *stormwater* runoff; and
 - iv. steps that contributors of non-*stormwater discharges* can take to reduce pollutants (non-*stormwater discharges* are listed in Part I.A.2);
- c. Educational materials may be made available at, locations including, but not limited to:
 - i. at service areas, lobbies, or other locations where information is made available;
 - ii. at staff training;
 - iii. on *covered entity's* website;
 - iv. with pay checks; and
 - v. in employee break rooms;
- d. *Develop (for newly authorized MS4s), record, periodically assess and modify as needed measurable goals; and*
- e. Select and implement appropriate education and outreach *activities* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- f. At a minimum, the *covered entity* shall report on the items below:
 - i. list education / outreach *activities* performed and provide any results (number of people attended, amount of materials distributed, etc.);
 - ii. education of the public about the hazards associated with illegal *discharges* and improper disposal of waste as required by Part VIII.A.3, may be reported in this section;
 - iii. *covered entity's* performing the education and outreach activities required by other MCMs (listed below), may report on those activities in MCM 1 and provide the following information applicable to their program:
 - IDDE education *activities* planned or completed for the public, as required by Part VIII.A.3;
 - construction site *stormwater* control training planned or completed, as required by Part VIII.A.4; and
 - employee pollution prevention / good housekeeping training planned or completed, as required by Part VIII.A.6;

To facilitate shared annual reporting, if the education and outreach activities

(Part VIII.A.1.f.iii.)

- above are implemented by a third party, and the third party is completing the associated portions of the annual report, that third party may report on the education and outreach activities within MCM 1 of the annual report and not within the MCMs that the education and outreach activities are required by;
- iv. report on effectiveness of program, *BMP* and *measurable goal* assessment; and
 - v. maintain records of all training activities
- g. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
- i. **program development deadlines and reporting:**
Complete in Year 1 (report changes in Year 2 and 3 as needed):
 - list (and describe if necessary) POCs;
 - *development* of education and outreach program and activities for the public that address *POCs*, geographic areas of concern, and / or *discharges to 303(d) / TMDL* waterbodies;
 - *covered entities* developing education and outreach programs required by other MCMs (listed below), may report on development (and implementation of those activities, if occurring during the three year development period) in MCM 1 and provide the following information applicable to their program:
 - IDDE education *activities* planned or completed for the public, as required by Part VIII.A.3;
 - construction site *stormwater* control training planned or completed, as required by Part VIII.A.4; and
 - employee pollution prevention / good housekeeping training planned or completed, as required by Part VIII.A.6.

To facilitate shared annual reporting, if the education and outreach activities above are implemented by a third party, and the third party is completing the associated portions of the annual report, that third party may report on the education and outreach activities within MCM 1 of the annual report and not within the MCMs that the education and outreach activities are required by.
 - ii. **Program implementation reporting** as set forth in Part VIII.A.1(f) above.
Commence *implementation* reporting after three year *development* period. *Implementation* reporting may begin earlier if *implementation* begins during *development* period.

2. Public Involvement/Participation - SWMP Development / Implementation

At a minimum, all *covered entities* must:

(Part VIII.A.2.)

- a. Comply with *State* and local public notice requirements identified below when implementing a public involvement / participation program:
 - i. *traditional non-land use control MS4s* shall comply with the *State Open Meetings Law* and local public notice requirements, such as *Open Meetings Law*; and
 - ii. *traditional non-land use control MS4s* and *non-traditional MS4s* may comply with this requirement by determining who their public is (staff, visitors, contractors, etc.) and posting notifications (as needed) in areas viewable by the public. Such areas include common areas, bulletin boards, agency/office web pages, etc. For *small MS4s* whose public are in multiple locations, notifications shall be made available to the public in all locations within the urbanized or additionally designated areas;
- b. Provide the opportunity for the public to participate in the *development, implementation, review, and revision* of the *SWMP*;
- c. **Local stormwater public contact.**

Identify a local point of contact for public concerns regarding *stormwater* management and compliance with this *SPDES general permit*. The name or title of this contact and the telephone number must be published in public outreach and public participation materials and kept updated with the *Department* on the MCC form;
- d. **Annual report presentation.**

Below are the requirements for the annual report presentation:

 - i. prior to submitting the final annual report to the *Department*, by June 1 of each reporting year (see Part V.C.), present the draft annual report in a format that is open to the public, where the public can ask questions and make comments on the report. This can be done:
 - at a meeting that is open to the public, where the public attendees are able to ask questions about and make comments on the report. This may be a regular meeting of an existing board. It may also be a separate meeting, specifically for *stormwater*. If multiple *covered entities* are working together, they may have a group meeting (refer to Part V.C.2); or
 - on the internet by:
 - making the annual report available to the public on a website:
 - providing the public the opportunity to provide comments on the internet or otherwise; and

(Part VIII.A.2.d.i.)

- making available the opportunity for the public to request an open public meeting to ask questions about and make comments on the report;
- ii. *traditional non-land use control MS4s* must comply with Part VIII.A.2.(d)(i) above. If they choose to present the draft annual report at a meeting, it may be presented at an existing meeting (e.g. a meeting of the Environmental Management Council , Water Quality Coordinating Committee, other agencies, or a meeting specifically for stormwater), or made available for review on the internet. The *covered entity* must make public the following information when noticing the presentation in accordance with *Open Meetings Law* or other local public notice requirements:
- the placement of the annual report on the agenda of this meeting or location on the internet;
 - the opportunity for public comment. This *SPDES general permit* does not require a specified time frame for public comments, although it is recommended that *covered entities* provide the public an opportunity to comment for a period after the meeting. Comments received after the final annual report is submitted shall be reported with the following year's annual report. *Covered entities* must take into account those comments in the following year;
 - the date and time of the meeting or date annual report becomes available on the internet; and
 - the availability of the draft report for review prior to the public meeting or duration of availability of the annual report on the internet;
- iii. *non-traditional MS4s* typically do not have regular meetings during which a presentation on the annual report can be made. Those *covered entities* may comply with this requirement by either:
- noticing the availability of the report for public comment by posting a sign, posting on web site, or other methods with information about the availability and location where the public can view it and contact information for those that read the report to submit comments; or
 - following the internet presentation as explained in Part VIII.A.2(d)(i) above;
- iv. the *Department* recommends that announcements be sent directly to individuals (public and private interested parties) known to have a specific interest in the covered entity's *SWMP*;

(Part VIII.A.2.d.)

- v. include a summary of comments and intended responses with the final annual report. Changes made to the *SWMP* in response to comments should be described in the annual report; and
- vi. ensure that a copy of the final report and, beginning in 2009, the *SWMP* plan are available for public inspection;
- e. *Develop (for newly authorized MS4s), record, periodically assess and modify as needed measurable goals; and*
- f. Select and implement appropriate public involvement / participation *activities* and *measurable goals* to ensure the reduction of all of the *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- g. **Program *implementation* reporting for continuing covered entities** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. annual report presentation information (date, time, attendees) or information about how the annual report was made available for comment;
 - ii. comments received and intended responses (as an attachment); and
 - iii. report on effectiveness of program, *BMP* and *measurable goal* assessment;
- h. Reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. **program development deadlines and reporting:**
Complete for Year 1, 2, and 3:
 - annual report presentation information (date, time, attendees) or information about how the annual report was made available for comment; and
 - comments received and intended responses (as an attachment).
 - ii. **program *implementation* reporting** as set forth in Part VIII.A.2.g above.
Commence *implementation* reporting after three year *development* period.
Implementation reporting may begin earlier if *implementation* begins during development period.

3. Illicit Discharge Detection and Elimination (IDDE) - SWMP Development / Implementation

At a minimum, all *covered entities* must:

(Part VIII.A.3.)

- a. *Develop (for newly authorized MS4s), implement and enforce a program to detect and eliminate illicit discharges (as defined at 40CFR 122.26(b)(2)) into the small MS4;*
- b. *Develop (for newly authorized MS4s) and maintain a map, at a minimum within the covered entity's jurisdiction in the urbanized area and additionally designated area, showing:*
 - i. *the location of all outfalls and the names and location of all surface waters of the State that receive discharges from those outfalls;*
 - ii. *by March 9, 2010, the preliminary boundaries of the covered entity's storm sewersheds determined using GIS or other tools, even if they extend outside of the urbanized area (to facilitate trackdown), and additionally designated area within the covered entity's jurisdiction; and*
 - iii. *when grant funds are made available or for sewer lines surveyed during an illicit discharge trackdown, the covered entity's storm sewer system in accordance with available State and EPA guidance;*
- c. *Field verify outfall locations;*
- d. *Conduct an outfall reconnaissance inventory, as described in the EPA publication entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment, addressing every outfall within the urbanized area and additionally designated area within the covered entity's jurisdiction at least once every five years, with reasonable progress each year;*
- e. *Map new outfalls as they are constructed or discovered within the urbanized area or additionally designated area;*
- f. *Prohibit illicit discharges into the small MS4 and implement appropriate enforcement procedures and actions below, as applicable:*
 - i. *for traditional non-land use control MS4s:*
 - *effectively prohibit, through a law, ordinance, or other regulatory mechanism, illicit discharges into the small MS4 and implement appropriate enforcement procedures and actions; and*
 - *the law, ordinance, or other regulatory mechanism must be equivalent to the State's model IDDE local law "NYSDEC Model Local Law to Prohibit Illicit Discharges, Activities and Connections to Separate Storm Sewer Systems" developed by the State, as determined and certified to be equivalent by the attorney representing the small MS4 ; and*

(Part VIII.A.3.f.)

- ii. for *non-traditional MS4s*:
 - prohibit and enforce against *illicit discharges* through available mechanisms (i.e. tenant lease agreements, bid specifications, requests for proposals, standard contract provisions, connection permits, maintenance directives / BMPS, access permits, consultant agreements, internal policies);
 - procedures or policies must be developed for implementation and enforcement of the mechanisms;
 - a written directive from the person authorized to sign the NOI stating that updated mechanisms must be used and who (position(s)) is responsible for ensuring compliance with and enforcing the mechanisms for the *covered entity's IDDE* program; and
 - the mechanisms and directive must be equivalent to the *State's* model illicit discharge local law;
- g. *Develop (for newly authorized MS4s) and implement* a program to detect and address non-stormwater *discharges*, including illegal dumping, to the *small MS4*. The program must include: procedures for identifying priority areas of concern (geographic, audiences, or otherwise) for IDDE program; description of priority areas of concern, available equipment, staff, funding, etc.; procedures for identifying and locating *illicit discharges* (trackdown); procedures for eliminating *illicit discharges*; and procedures for documenting actions;
- h. Inform the public of the hazards associated with illegal *discharges* and the improper disposal of waste;
- i. Address the categories of non-stormwater *discharges* or flows listed in Part I.A.2 as necessary and maintain records of notification;
- j. *Develop (for newly authorized MS4s)*, record, periodically assess, and modify as needed, *measurable goals*; and
- k. Select and implement appropriate IDDE *BMPs* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*

Required SWMP Reporting

- l. **Program *implementation* reporting** for **continuing *covered entities*** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. number and percent of *outfalls* mapped;

(Part VIII.A.3.I.)

- ii. number of *illicit discharges* detected and eliminated;
 - iii. percent of outfalls for which an outfall reconnaissance inventory has been performed. ;
 - iv. status of system mapping;
 - v. activities to and results from informing the public of hazards associated with illegal *discharges* and improper disposal of waste;
 - vi. for traditional non-land use control MS4s, regulatory mechanism status - certification that law is equivalent to the *State's* model *IDDE* local law (if not already completed and submitted with a prior annual report); and
 - vii. report on effectiveness of program, *BMP* and *measurable goal* assessment.
- m. Required reporting for **newly authorized covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
- i. **program development deadlines and reporting:**
 - Initiate by end of Year 1; complete by end of Year 3:
 - regulatory mechanism development and adoption - by end of Year 3 certify that regulatory mechanism is equivalent to the *State's* model *IDDE* local law (traditional non-land use control MS4s) or certification of equivalence may be accomplished as set forth in Part VIII.A.3(f)(ii).
 - Complete in Year 1 (revise in Year 2 and 3 if changes are made):
 - describe procedures for identifying priority areas of concern (geographic, audiences, or otherwise) for *IDDE* program;
 - describe priority areas of concern, available equipment, staff, funding, etc.;
 - Initiate by end of Year 1; complete by end of Year 2 (revise in Year 3 if changes are made):
 - describe procedures for identifying and locating *illicit discharges* (trackdown);
 - describe procedures for eliminating *illicit discharges*;
 - describe procedures for enforcing against illicit dischargers;
 - describe procedures for documenting actions;
 - describe the program being developed for informing the public of hazards associated with illegal *discharges* and improper disposal of waste;
 - Initiate by end of Year 2; complete by end of Year 3:
 - number and percent of *outfalls* mapped;

(Part VIII.A.3.m.i.)

Complete by Year 3:

- *outfall* map; and

- ii. **program implementation reporting** as set forth in Part VIII.A.3(l) above. Commence *implementation* reporting after three year *development* period. *Implementation* reporting may begin earlier if *implementation* begins during development period.

4. Construction Site Stormwater Runoff Control - SWMP Development / Implementation

At a minimum, all *covered entities* must:

- a. *Develop (for newly authorized MS4s), implement, and enforce* a program that:
 - i. provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from Construction Activities, unless more stringent requirements are contained within this *SPDES general permit*;
 - ii. addresses *stormwater* runoff to the *small MS4* from *construction activities* that result in a land disturbance of greater than or equal to one acre. Control of *stormwater discharges* from *construction activity* disturbing less than one acre must be included in the program if:
 - that *construction activity* is part of a *larger common plan of development or sale* that would disturb one acre or more; or
 - if controlling such activities in a particular watershed is required by the *Department*;
 - iii. incorporates mechanisms for construction runoff requirements from new development and redevelopment projects to the extent allowable under *State* and local law that meet the *State's* most current technical standards:
 - through available mechanisms (i.e. tenant lease agreements, bid specifications, requests for proposals, standard contract provisions, connection permits, maintenance directives / BMPS, access permits, consultant agreements, internal policies);
 - procedures or policies must be developed for implementation and enforcement of the mechanisms;
 - a written directive from the person authorized to sign the NOI stating that updated mechanisms must be used and who (position(s)) is responsible for ensuring compliance with and enforcing the mechanisms for construction projects that occur on property owned, under easement to, within the

(Part VIII.A.4.a.iii.)

right-of-way of, or under the maintenance jurisdiction by the *covered entity* or within the maintenance jurisdiction of the MS4; and

- the mechanisms and directive must be equivalent to the requirements of the NYS SPDES General Permit for Stormwater Discharges from Construction Activities.
- iv. allows for sanctions to ensure compliance to the extent allowable by *State* law;
- v. describes procedures for receipt and follow up on complaints or other information submitted by the public regarding construction site stormwater runoff;
- vi. educates construction site operators, design engineers, *municipal* staff and other individuals to whom these regulations apply about the construction requirements in the *covered entity's* jurisdiction, including the procedures for submission of *SWPPPs*, construction site inspections, and other procedures associated with control of construction stormwater;
- vii. Ensures that construction site contractors have received erosion and sediment control training, including the *trained contractors* as defined in the SPDES general permit for construction, before they do work within the *covered entity's* jurisdiction:
- training may be provided by the *Department* or other qualified entities (such as Soil and Water Conservation Districts);
 - the *covered entity* is not expected to perform such training, but they may co-sponsor training for construction site operators in their area;
 - the *covered entity* may ask for a certificate of completion or other such proof of training; and
 - the *covered entity* may provide notice of upcoming sediment and erosion control training by posting in the building department or distribute with building permit application.
- viii. establishes and maintains an inventory of active construction sites, including the location of the site, owner / operator contact information;
- ix. develop (*for newly authorized MS4s*), record, periodically assess and modify as needed *measurable goals*; and

(Part VIII.A.4.a.)

- x. select and implement appropriate construction stormwater *BMPs* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.

Required SWMP Reporting

- b. **Program *implementation* reporting for continuing *covered entities*** (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. number and type of sanctions employed;
 - ii. status of regulatory mechanism - certify that mechanisms will assure compliance with the NYS SPDES General Permit for Stormwater Discharges from Construction Activities;
 - iii. number of construction sites authorized for disturbances of one acre or more; and
 - iv. report on effectiveness of program, *BMP* and *measurable goal* assessment.

- c. Reporting for **newly regulated *covered entities*** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
 - i. **Program *development* deadlines and reporting:**
 - Initiate by end of Year 1:
 - procedures, activities and identify personnel to educate and train construction site operators about requirements to develop and implement a SWPPP and any other requirements that must be met within the MS4's jurisdiction;

 - Initiate by the end of Year 1; complete by the end of Year 3:
 - status of mechanism for construction runoff requirements - by end of Year 3 certify that mechanisms will assure compliance with the NYS SPDES General Permit for Stormwater Discharges from Construction Activities; and

 - Complete in Year 1 (revise in Year 2 and 3 if changes are made):
 - describe procedures for the receipt and consideration of information submitted by the public. Identify the responsible personnel.

 - ii. Program implementation reporting as set forth in Part VIII.A.4(b) above. Commence *implementation* reporting after three year development period. *Implementation* reporting may begin earlier if *implementation* begins during development period.

(Part VIII.A.)

5. Post-Construction Stormwater Management SWMP Development / Implementation

At a minimum, all *covered entities* must:

a. *Develop (for newly authorized MS4s), implement, and enforce* a program that:

- i. provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from Construction Activities, unless more stringent requirements are contained within this *SPDES general permit*;
- ii. addresses *stormwater* runoff from new development and redevelopment projects to the *small MS4* from projects that result in a land disturbance of greater than or equal to one acre. Control of *stormwater discharges* from projects of less than one acre must be included in the program if:
 - that project is part of a *larger common plan of development or sale*;
 - if controlling such activities in a particular watershed is required by the *Department*;
- iii. incorporates enforceable mechanisms for post-construction runoff control from new development and re-development projects to the extent allowable under *State* or local law that meet the *State's* most current technical standards:
 - through available mechanisms (i.e. tenant lease agreements, bid specifications, requests for proposals, standard contract provisions, connection permits, maintenance directives / BMPS, access permits, consultant agreements, internal policies);
 - procedures or policies must be developed for implementation and enforcement of the mechanisms;
 - a written directive from the person authorized to sign the NOI stating that updated mechanisms must be used and who (position(s)) is responsible for ensuring compliance with and enforcing the mechanisms for construction projects that occur on property owned by the *covered entity* or within the maintenance jurisdiction of the MS4; and
 - the mechanisms and directive must assure compliance with the requirements of the NYS SPDES General Permit for Stormwater Discharges from Construction Activities;
- iv. includes a combination of structural or non-structural management practices (according to standards defined in the most current version of the NYS Stormwater management Design Manual) that will reduce the *discharge* of pollutants to the MEP. In the development of environmental plans such as watershed plans, open space preservation programs, local laws, and ordinances covered entities must incorporate principles of *Low Impact Development (LID)*, *Better Site Design (BSD)* and other *Green Infrastructure* practices to the MEP.

(Part VIII.A.5.a.iv.)

Covered entities must consider natural resource protection, impervious area reduction, maintaining natural hydrologic condition in developments, buffers or set back distances for protection of environmentally sensitive areas such as streams, wetlands, and erodible soils in the development of environmental plans.

- if a *stormwater* management practice is designed and installed in accordance with the New York State Stormwater Management Design Manual or has been demonstrated to be equivalent and is properly operated and maintained, then *MEP* will be assumed to be met for the post construction *stormwater* discharged by the practice;
- v. establish and maintain an inventory of post-construction stormwater management practices to include at a minimum practices discharging to the *small MS4* that have been installed since March 10, 2003, those owned by the small MS4, and those found to cause water quality standard violations.
 - the inventory shall include, at a minimum: location of practice (street address or coordinates); type of practice; maintenance needed per the NYS Stormwater Management Design Manual, *SWPPP*, or other provided documentation; and dates and type of maintenance performed; and
- vi. ensures adequate long-term operation and maintenance of management practices by trained staff, including assessment to ensure that the practices are performing properly.
 - The assessment shall include the inspection items identified in the maintenance requirements (NYS Stormwater Management Design Manual, *SWPPP*, or other maintenance information) for the practice. *Covered entities* are not required to collect *stormwater* samples and perform specific chemical analysis;
- vii. Covered entities may include in the SWMP Plan provisions for development of a banking and credit system. MS4s must have an existing watershed plan based on which offsite alternative stormwater management in lieu of or in addition to on-site stormwater management practices are evaluated. Redevelopment projects must be evaluated for pollutant reduction greater than required treatment by the state standards. The individual project must be reviewed and approved by the *Department*. Use of a banking and credit system for new development is only acceptable in the impaired watersheds to achieve the no net increase requirement and watershed improvement strategy areas to achieve pollutant reductions in accordance with watershed plan load reduction goals. A banking and credit system must at minimum include:

(Part VIII.A.5.a.vii.)

- Ensures offset exceeds standard reduction by factor of at least 2
 - Offset is implemented within the same watershed
 - Proposed offset addresses the POC of the watershed
 - Tracking system is established for the watershed
 - Mitigation is applied for retrofit or redevelopment
 - Offset project is completed prior to beginning the proposed construction
 - A legal mechanism is established to implement the banking and credit system
- b. *Develop (for newly authorized MS4s), implement, and provide adequate resources for a program to inspect development and re-development sites by trained staff and to enforce and employ sanctions;*
- c. *Develop (for newly authorized MS4s), record, annually assess and modify as needed measurable goals; and*
- d. *Select and implement appropriate post-construction stormwater BMPs and measurable goals to ensure the reduction of all POCs in stormwater discharges to the MEP.*

Required SWMP Reporting

- e. Program *implementation* reporting for continuing *covered entities* (MS4s covered for 3 or more years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:
- i. number and type of sanctions;
 - ii. number and type of post-construction stormwater management practices;
 - iii. number and type of post-construction stormwater management practices inspected;
 - iv. number and type of post-construction stormwater management practices maintained;
 - v. status of regulatory mechanism, equivalent mechanism, that regulatory mechanism is equivalent; and
 - vi. report on effectiveness of program, *BMP* and *measurable goal* assessment, and implementation of a banking and credit system, if applicable.
- f. Program reporting for **newly regulated covered entities** (MS4s covered for less than 3 years on the *reporting date*). At a minimum, the *covered entity* shall report on the items below:

(Part VIII.A.5.f.)

i. program *development* deadlines and reporting:

Initiate by end of Year 1; complete by end of Year 3:

- mechanism of post-construction stormwater management - by end of Year 3 certify that mechanisms will assure compliance with the NYS Construction General Permit (GP-0-15-002);

Initiate by end of Year 2; complete by end of Year 3:

- procedures for inspection and maintenance of post-construction management practices; and
- procedures for enforcement and penalization of violators;

ii. program *implementation* reporting as set forth in Part VIII.A.5(e). Commence *implementation* reporting after three year development period. *Implementation* reporting may begin earlier if *implementation* begins during *development* period.

**6. Pollution Prevention/Good Housekeeping For Municipal Operations
SWMP Development / Implementation**

At a minimum, all *covered entities* must:

- Develop (for newly authorized MS4s) and implement* a pollution prevention / good housekeeping program for *municipal* operations and facilities that:
 - addresses *municipal* operations and facilities that contribute or potentially contribute *POCs* to the *small MS4* system. The operations and facilities may include, but are not limited to: street and bridge maintenance; winter road maintenance; stormwater system maintenance; vehicle and fleet maintenance; park and open space maintenance; municipal building maintenance; solid waste management; new construction and land disturbances; right-of-way maintenance; marine operations; hydrologic habitat modification, or other;
 - includes the performance and documentation of a self assessment of all municipal operations to:
 - determine the sources of pollutants potentially generated by the *covered entity's* operations and facilities; and
 - identify the *municipal* operations and facilities that will be addressed by the pollution prevention and good housekeeping program, if it is not done already;
 - determines *management practices*, policies, procedures, etc. that will be *developed* and *implemented* to reduce or prevent the discharge of (potential)

(Part VIII.A.6.a.iii.)

- pollutants. Refer to *management practices* identified in the “NYS Pollution Prevention and Good Housekeeping Assistance Document” or other guidance materials available from the EPA, the *State*, or other organizations;
- iv. prioritizes pollution prevention and good housekeeping efforts based on geographic area, potential to improve water quality, facilities or operations most in need of modification or improvement, and *covered entity's* capabilities;
 - v. addresses pollution prevention and good housekeeping priorities;
 - vi. includes an employee pollution prevention and good housekeeping training program and ensure that staff receive and utilize training;
 - vii. requires third party entities performing contracted services, including but not limited to, street sweeping, snow removal, lawn / grounds care, etc., to make the necessary certification in Part IV.G; and
 - viii. requires *municipal* operations and facilities that would otherwise be subject to the NYS Multisector General Permit (MSGP, GP-0-12-001) for industrial stormwater discharges to prepare and *implement* provisions in the SWMP that comply with Parts III. A, C, D, J, K and L of the MSGP. The covered entity must also perform monitoring and record keeping in accordance with Part IV. of the MSGP. Discharge monitoring reports must be attached to MS4 annual report. Those operations or facilities are not required to gain coverage under the MSGP. *Implementation* the above noted provisions of the SWMP will ensure that MEP is met for discharges from those facilities;
- b. Consider and incorporate cost effective runoff reduction techniques and green infrastructure in the routine upgrade of the existing stormwater conveyance systems and municipal properties to the MEP. Some examples include replacement of closed drainage with grass swales, replacement of the existing islands in parking lots with rain garden, or curb cuts to route the flow through below grade infiltration areas or other low cost improvements that provide runoff treatment or reduction.
 - c. *Develop (for newly authorized MS4s)*, record, periodically assess and modify as needed *measurable goals*; and

(Part VIII.A.6.)

- d. Select and implement appropriate pollution prevention and good housekeeping *BMPs* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the *MEP*.
- e. Adopt techniques to reduce the use of fertilizers, pesticides, and herbicides, as well as potential impact to surface water.

Required SWMP Reporting

- f. **Program *implementation* reporting for continuing *covered entities*** (MS4s covered for 3 or more years on the *reporting date*). *Covered entities* are required to report on all *municipal* operations and facilities within their jurisdiction (*urbanized area* and *additionally designated area*) that their program is addressing. The *covered entity* shall report at a minimum on the items below:
 - i. indicate the *municipal* operations and facilities that the pollution prevention and good housekeeping program assessed;
 - ii. describe, if not done so already, the management practices, policies and procedures that have been developed, modified, and / or implemented and report, at a minimum, on the items below that the *covered entity's* pollution prevention and good housekeeping program addresses during the reporting year:
 - acres of parking lot swept;
 - miles of street swept;
 - number of catch basins inspected and, where necessary, cleaned;
 - post-construction control stormwater management practices inspected and, where necessary, cleaned;
 - pounds of phosphorus applied in chemical fertilizer
 - pounds of nitrogen applied in chemical fertilizer; and
 - acres of pesticides / herbicides applied.
 - iii. staff training events and number of staff trained; and
 - iv. report on effectiveness of program, *BMP* and *measurable goal* assessment. If the pollution prevention and good housekeeping program addresses other operations than what is listed above in Part VIII.A.6.a(ii), the *covered entity* shall report on items that will demonstrate program effectiveness.
- g. Reporting for **newly regulated *covered entities*** (MS4s covered for less than 3 years on the *reporting date*). *Covered entities* are required to report on all *municipal* operations and facilities within their jurisdiction (*urbanized area* and *additionally*

(Part VIII.A.6.g.)

designated area) that their program is addressing. The *covered entity* shall report at a minimum on the items below:

i. program *development* deadlines and reporting:

Complete by end of Year 1:

- identify the municipal operations and facilities that will be considered for inclusion in the pollution prevention and good housekeeping program;
- describe the pollution prevention and good housekeeping program priorities (geographic area, potential to improve water quality; facilities or operations most in need of modification or improvement);
- describe management practices, policies, procedures, etc. that will be developed or modified;
- identify the staff and equipment available;

Initiate by Year 2; complete Year 3:

- describe employee pollution prevention and good housekeeping program training program and begin training, report on number of staff trained;

Complete by end of Year 3:

- description of developed management practices.

ii. program *implementation* reporting as set forth in Part VIII.A.6(d) above. Commence *implementation* reporting after three year *development* permit. *Implementation* reporting may begin earlier if *implementation* begins during *development* period.

Part IX. WATERSHED IMPROVEMENT STRATEGY REQUIREMENTS

The covered entities in the watershed improvement strategy areas must develop or modify their SWMP to address the additional watershed specific requirements to achieve the pollutant load reduction by the deadlines specified in Tables IX.A through D. The requirements contained in this Part are in addition to the applicable requirements in Part VII or VIII, depending on the type of MS4. The Pollutant Load Reductions are the reductions necessary from the discharge loads associated with MS4s that, when combined with reductions in the discharge loads from non-MS4s to the waterbody, will meet water quality standards. The calculated reductions are based on TMDL models and may be recalculated according to 40CFR Part 130.

The MS4 portion of the pollutant load reduction shall be achieved by implementation of BMPs required of all MS4s, reductions from implementation of additional BMPS for watershed improvement strategy areas including any retrofits required by this permit. These reductions are intended to be targeted and credited using models, loading factors and load reductions predicted based on the best scientific information available. In accordance with NYCRR Part 750-1.14, all covered entities that own or operate MS4s in the watershed improvement strategy areas shall submit to the Department progress reports, described in Part V.D, identifying the activities that have been performed during the period of March 10 through September 9 of each year, and demonstrating that progress is being made towards completion of the reduction requirements, as required by this Part.

The Pollutant Load Reduction Deadlines are deadlines by which the MS4 portion of the pollutant load reduction must be met. Watershed Improvement Strategy Deadlines are the deadlines by which the watershed improvement strategy requirements for addressing the POC are to be completed and implemented. Retrofit Plan Submission Deadlines are the deadlines by which the retrofit plan component of the watershed improvement strategies are submitted to the *Department* for review and approval.

Ultimately, the effectiveness of the load reductions in meeting water quality standards will be verified by ambient monitoring of the affected waterbody. Where ambient monitoring demonstrates consistent compliance with water quality standards, the covered entity may request that the *Department* suspend the additional BMP requirements to install stormwater retrofits.

(Part IX.)

A. New York City East of Hudson Watershed MS4s - (Mapped in Appendix 3)

Table IX.A - Pollutant Load Reduction and Timetable for New York City East of Hudson Phosphorus Watershed Improvement Strategy Area

Watershed	Watershed Improvement Strategy Deadline	Retrofit Plan Submission Deadline	Pollutant Load Reduction (Load Allocation)	Pollutant Load Reduction Deadline
New York City East of Hudson Watershed	05/01/2011	03/09/ 2009 (single) and 12/ 31/2009 (RSE)	In accordance with the TMDL Implementation Plan	03/09/2019 (single) 12/31/2019 (RSE)

By the deadlines specified in Table IX.A, covered entities that own or operate MS4s within the listed watershed shall develop and implement the following pollutant specific BMPs. Covered entities that own or operate MS4s in these watersheds shall also submit to the Department, progress reports as specified in Part V.D.

1. Public Education and Outreach on Stormwater Impacts- applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

- a. Plan and conduct an ongoing public education and outreach program designed to describe the impacts of phosphorus (the *POC*) on waterbodies. The program must identify potential sources of phosphorus in *stormwater* runoff and describe steps that contributors can take to reduce the concentration of this *POC* in *stormwater* runoff. The program must also describe steps that contributors of non-*stormwater* discharges (Part I.A.2) can take to reduce phosphorus.
- b. Develop, or acquire if currently available, specific educational material dealing with sources of phosphorus in *stormwater* and pollutant reduction practices. At a minimum, the educational material should address the following topics:
 - i. understanding the phosphorus issue;
 - ii. septic systems as a source of phosphorus;
 - iii. phosphorus concerns with fertilizer use;
 - iv. phosphorus concerns with grass clippings and leaves entering streets and storm sewers;
 - v. construction sites as a source of phosphorus; and

- vi. phosphorus concerns with detergent use.

2. Public Involvement/ Participation

No additional requirements proposed for this permit term.

3. Illicit Discharge Detection and Elimination

a. Mapping - applicable to *traditional land use control*, *traditional non-land use control* and *non-traditional MS4s*.

Develop and maintain a map showing the entire *small MS4* conveyance system. The *covered entity* shall complete the mapping of approximately 20% of the system every year, with the entire system being mapped by January 8, 2013.

At a minimum, the map and/or supportive documentation for the conveyance system should include the following information:

- i. type of conveyance system - closed pipe or open drainage;
- ii. for closed pipe systems - pipe material, shape, and size;
- iii. for open drainage systems - channel/ditch lining material, shape, and dimensions; location and dimensions of any culvert crossings;
- iv. drop inlet, catch basin, and manhole locations; and
- v. number and size of connections (inlets/outlets) to catch basins and manholes, direction of flow.

All information shall be prepared in digital format suitable for use in GIS software and in accordance with the *Department's* guidance on Illicit Discharge Detection and Elimination. The scale shall be 1:24,000 or better.

b. On-site wastewater systems - applicable to *traditional land use control* and *traditional non-land use control MS4s*.

- *Develop, implement* and enforce a program that ensures that on-site sanitary systems designed for less than 1000 gallons per day (septic systems, cesspools, including any installed absorption fields) are inspected at a minimum frequency of once every five years and, where necessary, maintained or rehabilitated. Regular field investigations/inspections should be done in accordance with the most current

version of the EPA publication entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment, to detect the presence of ongoing and/or intermittent on-site sanitary discharges to the storm sewer system. An advanced system inspection requiring completion by a certified professional is not required by this permit, but may be used where site specific conditions warrant. Program development shall include the establishment of the necessary legal authority to implement the program.

4. Construction Site Stormwater Runoff Control- applicable to *traditional land use control MS4s*.

- a. *Develop, implement* and enforce a program to reduce pollutants in *stormwater* runoff to the *small MS4* from construction activities that result in a land disturbance of greater than or equal to five thousand (5000) square feet. At a minimum, the program must provide equivalent protection to the NYS DEC SPDES General Permit for Stormwater Discharges from Construction Activity and must include the development and implementation of:
 - i. by December 31, 2009, an ordinance or other regulatory mechanism that requires erosion and sediment controls designed in accordance with the most current version of the technical standard New York State Standards and Specifications for Erosion and Sediment Control for all construction activities that disturb between five thousand (5000) square feet and one acre of land. For construction activities that disturb between five thousand (5000) square feet and one (1) acre of land, one of the standard erosion and sediment control plans included in Appendix E (Erosion & Sediment Control Plan For Small Homesite Construction) of the New York Standards and Specifications for Erosion and Sediment Control may be used as the Stormwater Pollution Prevention Plan (SWPPP);
 - ii. policy and procedures for the *covered entity* to perform, or cause to be performed, compliance inspections at all sites with a disturbance of one (1) or more acres. By December 31, 2009, the *covered entity* shall have started performing, or cause to be performed, compliance inspections at all sites with a disturbance between five thousand (5000) square feet and one (1) acre of land;

5. Post-Construction Stormwater Management

- a. Construction stormwater program - applicable to *traditional land use control, traditional non-land use control* and *non-traditional MS4s*.

(Part IX.A.5.a.)

Develop, *implement* and enforce a program to address post-construction *stormwater* runoff from new development and redevelopment projects that disturb greater than or equal to one (1) acre. This includes projects of less than one acre that are part of a larger common plan of development or sale. At a minimum, the program must provide equivalent protection to the NYS DEC SPDES General Permit for Stormwater Discharges from Construction Activity and must include the *development* and *implementation* of:

- i. a law or other mechanism that requires post-construction stormwater management controls designed in accordance with the most current version of the technical standards the New York State Stormwater Management Design Manual including the Enhanced Phosphorus Removal Design Standards. An MS4 must ensure that their ordinance or other mechanism requires post-construction stormwater management controls to be designed in accordance with the final version of the Enhanced Phosphorus Removal Design Standards by September 30, 2008.
- b. Retrofit program - applicable to *traditional land use control, traditional non-land use control* and *non-traditional MS4s*.

Develop and commence implementation of a Retrofit Program that addresses runoff from sites to correct or reduce existing erosion and/or pollutant loading problems, with a particular emphasis placed on the pollutant phosphorus. At a minimum, the MS4 shall:

- i. establish procedures to identify sites with erosion and/or pollutant loading problems;
- ii. establish policy and procedures for project selection. Project selection should be based on the phosphorus reduction potential of the specific retrofit being constructed/installed; the ability to use standard, proven technologies; and the economic feasibility of constructing/installing the retrofit. As part of the project selection process, the *covered entity* should participate in locally based watershed planning efforts which involve the *Department, other covered entities, stakeholders* and other interested parties;
- iii. establish policy and procedures for project permitting, design, funding, construction and maintenance.

(Part IX.A.5.b.)

- iv. for covered entities that develop their own retrofit program, by March 9, 2009 develop and submit approvable plans with schedules for completing retrofit projects, including identification of funding sources. Upon DEC approval of those schedules, the plans and schedules shall become enforceable requirements of this permit.
- v. pursuant to Part IV. B (Cooperation Between Covered entities Encouraged), retrofit projects can be completed in cooperation with other covered entities in the East of Hudson Watershed through the formation of a cooperative entity with other MS4s. Participating MS4s shall work with the Department and other members of the cooperative entity in implementing the requirements of i, ii and iii above. In addition, each covered entity that becomes a member of the cooperative entity shall work closely with the Department and other members of the cooperative entity to, by December 31, 2009, develop and submit approvable plans and schedules for completing retrofit projects, including identification of funding sources. Upon DEC approval of those plans and schedules, the plans and schedules shall become enforceable requirements of this permit.

6. Pollution Prevention/Good Housekeeping For Municipal Operations- applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

- a. By December 31, 2009, develop and implement a Stormwater Conveyance System inspection and maintenance program. At a minimum, the program shall include the following:
 - i. policy and procedures for the inspection and maintenance of catch basin and manhole sumps. Catch basin and manhole sumps should be inspected in the early spring and late fall for sediment and debris build-up. If sediment and debris fills greater than 50% of the sump volume, the sump should be cleaned. All sediment and debris removed from the catch basins and manholes shall be properly disposed of;
 - ii. policy and procedures for the inspection, maintenance and repair of conveyance system *outfalls*. Beginning June 30, 2008, the MS4 must inspect 20% of their *outfalls* each year and make repairs as necessary. All outfall protection and/or bank stability problems identified during the inspection shall be corrected in accordance with the New York Standards and Specifications for Erosion and Sediment Control;

(Part IX.A.6.a.)

- iii. policy and procedures for the inspection, maintenance and repair of a *covered entity's* stormwater management practices. The inspection and maintenance schedule for all stormwater management practices shall assure continued operation of stormwater management practices; and
 - iv. develop a Corrective Action Plan for each Stormwater Conveyance System component that has been identified as needing repair. A file of all corrective actions implemented and *illicit discharges* detected and repaired should be maintained for a period of not less than five years.
- b. By December 31, 2010, develop and implement a turf management practices and procedures policy. The policy shall address the following:
- i. procedures for proper fertilizer application on municipally-owned lands. The application of any phosphorus-containing fertilizer (as labeled) shall only be allowed following a proper soil test and analysis documenting that soil phosphorus concentrations are inadequate;
 - ii. procedures for the proper disposal of grass clippings from municipally-owned lawns where grass clipping collection equipment is used. Grass clippings shall be disposed of in a compost pile or a proper containment device so that they cannot enter the *small MS4* or surface waters;
 - iii. procedures for the proper disposal of leaves from municipally-owned lands where leaves are collected. Leaves shall be disposed of in a compost pile or a proper containment device so that they cannot enter *small MS4s* or surface waters;
 - iv. for municipalities with lawn waste collection programs, the development of a curbside lawn waste management policy which ensures that lawn waste does not decay and release phosphorus to the storm sewer system; and
 - v. the planting of wildflowers and other native plant material to lessen the frequency of mowing and the use of chemicals to control vegetation.

(Part IX.)

B. Other Phosphorus Watershed MS4s (Mapped in Appendices 4, 5, and 10)

Table IX.B - Pollutant Load Reduction and Timetable for Other Phosphorus Watershed Improvement Strategy Areas

Watershed	Watershed Improvement Strategy Deadline	Retrofit Plan Submission Deadline	Pollutant Load Reduction (Waste Load Allocation %*)	Pollutant Load Reduction Deadline
Greenwood Lake	05/01/2011	03/09/2011	43* (load allocation)	03/09/2011
Onondaga Lake	TMDL approval + 3 years	TMDL approval + 3 years	TBD	TMDL approval + 13 years
Oscawana Lake	05/01/2013	Not Applicable	18	2020

By the deadlines specified in Table IX.B, covered entities that own or operate MS4s within the listed watersheds shall develop and implement the following pollutant specific BMPs for MS4 sewersheds discharging to the listed waterbody. Covered entities that own or operate MS4s in these watersheds shall also submit to the Department, progress reports as specified in Part V.D.

1. Public Education and Outreach on Stormwater Impacts- applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

- a. Plan and conduct an ongoing public education and outreach program designed to describe the impacts of phosphorus (the POC) on waterbodies. The program must identify potential sources of Phosphorus in stormwater runoff and describe steps that contributors can take to reduce Phosphorus in stormwater runoff.
- b. develop, or acquire if currently available, specific educational material dealing with sources of Phosphorus in stormwater and pollutant reduction practices. At a minimum, the educational material should address the following topics:
 - i. understanding the phosphorus issue;
 - ii. septic systems as a source of phosphorus; and
 - iii. phosphorus concerns with fertilizer use.

2. Public Involvement/ Participation

No additional requirements proposed for at this time.

3. Illicit Discharge Detection and Elimination applicable to *traditional land use control and traditional non-land use control MS4s, except within the Onondaga Lake Watershed.*

- a. *Develop, implement and enforce* a program that ensures that on-site sanitary systems designed for less than 1000 gallons per day (septic systems, cesspools, including any installed absorption fields) are inspected at a minimum frequency of once every five

years and, where necessary, maintained or rehabilitated. Conduct of regular field investigations/inspections should be done in accordance with the most current version of the EPA publication entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment, to detect the presence of ongoing and/or intermittent on-site sanitary discharges to the storm sewer system. An advanced system inspection requiring completion by a certified professional is not required by this permit, but may be used where site specific conditions warrant. Program development shall include the establishment of the necessary legal authority to implement the program.

4. Construction Site Stormwater Runoff Control

No additional requirements at this time.

5. Post-Construction Stormwater Management, - applicable to *traditional land use, traditional non-land use control and non-traditional MS4s*.

- a. The *covered entity* must require the use of the “Enhanced Phosphorus Removal Design Standards” in accordance with NYS Stormwater Design Manual;
- b. *Develop* and commence implementation of a Retrofit Program that addresses runoff from sites to correct or reduce existing erosion and/or pollutant loading problems, with a particular emphasis placed on the pollutant Phosphorus. At a minimum, the MS4 shall:
 - i. establish procedures to identify sites with erosion and/or pollutant loading problems;
 - ii. establish policy and procedures for project selection. Project selection should be based on the Phosphorus reduction potential of the specific retrofit being constructed/installed; the ability to use standard, proven technologies; and the economic feasibility of constructing/installing the retrofit. As part of the project selection process, the *covered entity* should participate in locally based watershed planning efforts which involve the *Department*, other *covered entities*, stakeholders and other interested parties;
 - iii. establish policy and procedures for project permitting, design, funding, construction and maintenance
 - iv. by the date specified for each watershed in the appropriate Watershed Improvement Strategy Requirement Table develop and submit approvable plans and schedules for completing retrofit projects, including identification of funding

sources. Upon DEC approval of those plans and schedules, the plans and schedules shall become enforceable requirements of this permit.

6. Pollution Prevention/Good Housekeeping For Municipal Operations applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

- a. Develop a turf management practices and procedures policy. The policy should address the following:
 - i. procedures for proper fertilizer application on municipally-owned lands. The application of any phosphorus-containing fertilizer (as labeled) shall only be allowed following a proper soil test and analysis documenting that soil phosphorus concentrations are inadequate; and
 - ii. the planting of native plant material to lessen the frequency of mowing and the use of chemicals to control vegetation.

(Part IX.)

C. Pathogen Impaired Watershed MS4s (Mapped in Appendix 6, 7 and 9)

Table IX.C - Pollutant Load Reduction and Timetable for Pathogen Impaired Watershed Improvement Strategy Areas

Watershed	Watershed Improvement Strategy Deadline	Retrofit Plan Submission Deadline	Pollutant Load Reduction (Waste Load Allocation %)	Pollutant Load Reduction Deadline
Budds Pond*	05/01/2013	09/30/2012	61	09/30/2022
Stirling Creek*	05/01/2013	09/30/2012	28	09/30/2022
Town & Jockey Creeks*	05/01/2013	09/30/2012	76	09/30/2022
Goose Creek*	05/01/2013	09/30/2012	70	09/30/2022
Hashamomuck Pond, Zone HP-1*	05/01/2013	09/30/2012	77	09/30/2022
Hashamomuck Pond , Zone HP-2*	05/01/2013	09/30/2012	43	09/30/2022
Richmond Creek*	05/01/2013	09/30/2012	71	09/30/2022
Deep Hole Creek*	05/01/2013	09/30/2012	29	09/30/2022
James Creek*	05/01/2013	09/30/2012	51	09/30/2022
Flanders Bay	05/01/2012	03/09/2012	98	03/09/2021
Reeves Bay	05/01/2012	03/09/2012	97	03/09/2021
Sebonac Creek	05/01/2012	03/09/2012	58	03/09/2021
North Sea Harbor, Zone NSH-1	05/01/2012	03/09/2012	97	03/09/2021
North Sea Harbor, Zone NSH-2	05/01/2012	03/09/2012	62	03/09/2021
North Sea Harbor, Zone NSH-3	05/01/2012	03/09/2012	99	03/09/2021
North Sea Harbor, Zone NSH-5	05/01/2012	03/09/2012	74	03/09/2021
Wooley Pond	05/01/2012	03/09/2012	97	03/09/2021
Noyac Creek, Zone NC-1	05/01/2012	03/09/2012	64	03/09/2021
Sag Harbor, Zone SH-2*	05/01/2013	09/30/2012	50	09/30/2022
Northwest Creek*	05/01/2013	09/30/2012	76	09/30/2022
Acabonac Harbor, Zone AH-2*	05/01/2013	09/30/2012	42	09/30/2022
Acabonac Harbor, Zone AH-3*	05/01/2013	09/30/2012	85	09/30/2022
Acabonac Harbor, Zone AH-4*	05/01/2013	09/30/2012	81	09/30/2022
Acabonac Harbor, Zone AH-5*	05/01/2013	09/30/2012	87	09/30/2022
Montauk Lake, Zone LM-1*	05/01/2013	09/30/2012	52	09/30/2022
Montauk Lake, Zone LM-2*	05/01/2013	09/30/2012	52	09/30/2022
Montauk Lake, Zone LM-3*	05/01/2013	09/30/2012	48	09/30/2022
Little Sebonac Creek	05/01/2012	03/09/2012	70	03/09/2021
Oyster Bay (Harbor 2)	05/01/2012	03/09/2012	20	03/09/2021
Oyster Bay (Harbor 3)	05/01/2012	03/09/2012	90	03/09/2021

*Additionally Designated Area

Watershed	Watershed Improvement Strategy Deadline	First Retrofit Plan Submission Deadline	Pollutant Reduction (Waste Load Allocation %)	Pollutant Load Reduction Deadline
Hempstead Harbor, north, and tidal tributaries	05/01/2013	09/30/2012	95	09/30/2022
Cold Spring Harbor, and tidal tributaries, Inner	05/01/2013	09/30/2012	95	09/30/2022
Cold Spring Harbor, Eel Creek	05/01/2013	09/30/2012	90	09/30/2022
Huntington Harbor	05/01/2013	09/30/2012	89	09/30/2022
Centerport Harbor	05/01/2013	09/30/2012	91	09/30/2022
Northport Harbor	05/01/2013	09/30/2012	92	09/30/2022
Stony Brook Harbor and West Meadow Creek	05/01/2013	09/30/2012	99	09/30/2022
Stony Brook Creek	05/01/2013	09/30/2012	99	09/30/2022
Stony Brook Yacht Club	05/01/2013	09/30/2012	48	09/30/2022
Port Jefferson Harbor, North and tribs	05/01/2013	09/30/2012	94	09/30/2022
Conscience Bay and tidal tribs	05/01/2013	09/30/2012	99	09/30/2022
Setauket Harbor, Little Bay	05/01/2013	09/30/2012	84	09/30/2022
Setauket Harbor, East Setauket	05/01/2013	09/30/2012	79	09/30/2022
Setauket Harbor, Poquot	05/01/2013	09/30/2012	100	09/30/2022
Mt. Sinai Harbor, Crystal Brook	05/01/2013	09/30/2012	88	09/30/2022
Mt. Sinai Harbor, Inner Harbor	05/01/2013	09/30/2012	96	09/30/2022
Mt. Sinai Harbor, Pipe Stave Hollow	05/01/2013	09/30/2012	93	09/30/2022
Mattituck Inlet/Creek, Low, and tidal tributaries	05/01/2013	09/30/2012	64	09/30/2022
Goldsmith Inlet	05/01/2013	09/30/2012	91	09/30/2022
West Harbor - Darby Cove	05/01/2013	09/30/2012	41	09/30/2022
Georgica Pond, Upper	05/01/2013	09/30/2012	93	09/30/2022

Georgica Pond, Lower	05/01/2013	09/30/2012	93	09/30/2022
Georgica Pond Cove	05/01/2013	09/30/2012	92	09/30/2022
Sagaponack Pond	05/01/2013	09/30/2012	88	09/30/2022
Mecox Bay and tributaries	05/01/2013	09/30/2012	89	09/30/2022
Heady Creek and tributaries	05/01/2013	09/30/2012	88	09/30/2022
Taylor Creek and tributaries	05/01/2013	09/30/2012	52	09/30/2022
Penny Pond	05/01/2013	09/30/2012	31	09/30/2022
Weesuck Creek and tidal tributaries	05/01/2013	09/30/2012	37	09/30/2022
Penniman Creek and tidal tributaries	05/01/2013	09/30/2012	32	09/30/2022
Ogden Pond	05/01/2013	09/30/2012	28	09/30/2022
Quantuck Bay-Quantuck Creek	05/01/2013	09/30/2012	91	09/30/2022
Quantuck Canal/Moneybogue Bay	05/01/2013	09/30/2012	62	09/30/2022
Seatuck Cove	05/01/2013	09/30/2012	94	09/30/2022
Harts Cove	05/01/2013	09/30/2012	12	09/30/2022
Narrow Bay	05/01/2013	09/30/2012	16	09/30/2022
Bellport Bay, Beaver Dam Creek	05/01/2013	09/30/2012	94	09/30/2022
Bellport Bay, West Cove	05/01/2013	09/30/2012	94	09/30/2022
Patchogue Bay, Swan River	05/01/2013	09/30/2012	90	09/30/2022
Patchogue Bay, Mud Creek	05/01/2013	09/30/2012	71	09/30/2022

By the deadlines specified in Table IX.C, covered entities that own or operate MS4s within the listed watersheds shall develop and implement the following pollutant specific BMPs in MS4 sewersheds discharging to the listed waters. Covered entities who own or operate MS4s within these watersheds shall also submit to the Department, progress reports as specified in Part V.D.

(Part IX.C)

1. Public Education and Outreach on Stormwater Impacts- applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s*

a. Plan and conduct an ongoing public education and outreach program designed to describe the impacts of Pathogens (the *POC*) on waterbodies. The program must identify potential sources of Pathogens in *stormwater* runoff and describe steps that contributors can take to reduce the Pathogens in *stormwater* runoff. The program must also describe steps that contributors of non-*stormwater discharges* can take to reduce Pathogens.

b. *Develop*, or acquire if currently available, specific educational material dealing with sources of Pathogens in *stormwater* and pollutant reduction practices. At a minimum, the educational material should address the following topics:

i. where, why, and how Pathogens pose threats to the environment and to the community;

ii. septic systems, geese and pets as a source of pathogens;

iii. dissemination of educational materials / surveys to households/businesses in proximity to Pathogen *TMDL* waterbodies; and

iv. education for livestock / horse boarders regarding manure *BMPs*.

2. Public Involvement / Participation

No additional requirements proposed at this time.

3. Illicit Discharge Detection and Elimination, SWMP Development / Implementation- Mapping applicable to *traditional land use control and traditional non-land use control MS4s*.

a. Develop, implement, and enforce a program to detect and eliminate discharges to the municipal separate storm sewer system from on-site sanitary systems in areas where factors such as shallow groundwater, low infiltrative soils, historical on-site sanitary system failures, or proximity to pathogen-impaired waterbodies, indicate a reasonable likelihood of system discharge.

In such areas, ensure that on-site sanitary systems designed for less than 1000 gallons per day (septic systems, cesspools, including any installed absorption fields) are inspected at a minimum frequency of once every five years and, where necessary, maintained or rehabilitated. Conduct regular field investigations/inspections in accordance with the most current version of the EPA publication entitled Illicit Discharge

(Part IX.C.3.a)

Detection and Elimination: A Guidance Manual for Program Development and Technical Assessment, to detect the presence of ongoing and/or intermittent on-site sanitary discharges to the storm sewer system. An advanced system inspection requiring completion by a certified professional is not required by this permit, but may be used where site specific conditions warrant.

On-site sanitary system IDDE program development shall include the establishment of the necessary legal authority (such as new or revised local laws) for implementation and enforcement.

b. Develop and maintain a map showing the entire *small MS4* conveyance system. The *covered entity* shall complete the mapping of approximately 20% of the system every year, with the entire system being mapped by May 1, 2015. At a minimum, the map and/or supportive documentation for the conveyance system shall include the following information:

- i. type of conveyance system - closed pipe or open drainage;
- ii. for closed pipe systems - pipe material, shape, and size;
- iii. for open drainage systems - channel/ditch lining material, shape, and dimensions; location and dimensions of any culvert crossings;
- iv. drop inlet, catch basin, and manhole locations; and
- v. number and size of connections (inlets/outlets) to catch basins and manholes, direction of flow.

All information shall be prepared in digital format suitable for use in GIS software and in accordance with the *Department's* guidance on Illicit Discharge Detection and Elimination. The scale shall be 1:24000 or better.

4. Construction Site Stormwater Runoff Control

No additional requirements at this time.

5. Post-Construction Stormwater Management- applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

Develop and commence implementation of a Retrofit Program that addresses runoff from sites to correct or reduce pollutant loading problems, with a particular emphasis placed on the pollutant Pathogens. At a minimum, the MS4 shall:

- a. establish procedures to identify sites with erosion and/or pollutant loading problems;

(Part IX.C.5.)

- b. establish policy and procedures for project selection. Project selection should be based on the Pathogen reduction potential of the specific retrofit being constructed/installed; the ability to use standard, proven technologies; and the economic feasibility of constructing/installing the retrofit. As part of the project selection process, the *covered entity* should participate in locally based watershed planning efforts which involve the *Department*, other *covered entities*, stakeholders and other interested parties;
- c. establish policy and procedures for project permitting, design, funding, construction and maintenance
- d. by March 9, 2011, develop and submit approvable plans and schedules for completing retrofit projects. Upon DEC approval of those plans and schedules and identification of funding sources, the plans and schedules shall become enforceable requirements of this permit.

6. Pollution Prevention/Good Housekeeping For Municipal Operations, - applicable to *traditional land use control* and traditional non-land use control MS4s.

- a. *Develop*, enact and enforce a local law prohibiting pet waste on municipal properties and prohibiting goose feeding.
- b. *Develop* and *implement* a pet waste bag program for collection and proper disposal of pet waste.
- c. *Develop* a program to manage goose populations.

(Part IX.)

D. Nitrogen Watershed MS4s (Mapped in Appendix 8)

Table IX.D - Pollutant Load Reduction and Timetable for Nitrogen Watershed Improvement Strategy Area

Watershed	Watershed Improvement Strategy Deadline	Retrofit Plan Submission Deadline	Pollutant Reduction (Load Allocation %)	Pollutant Load Reduction Deadline
Lower Peconic River & Tidal Tributaries	05/01/2011	03/09/2011	15	03/09/2021
Western Flanders Bay & Lower Sawmill Creek				
Meetinghouse Creek				
Terrys Creek & Tributaries				

By the deadlines specified in Table IX.D, covered entities that own or operate MS4s within the listed watersheds shall develop and implement the following pollutant specific BMPs for MS4 sewersheds discharging to the listed waterbodies. Covered entities that own or operate MS4s within these watersheds shall also submit to the Department, progress reports as specified in Part V.D.

1. Public Education and Outreach on Stormwater Impacts - applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s.*

- a. Plan and conduct an ongoing public education and outreach program designed to describe the impacts of Nitrogen (the POC) on waterbodies. The program must identify potential sources of Nitrogen in stormwater runoff and describe steps that contributors can take to reduce the Nitrogen in stormwater runoff.
- b. develop, or acquire if currently available, specific educational material dealing with sources of Nitrogen in stormwater and pollutant reduction practices. At a minimum, the educational material should address the following topics:
 - i. understanding the Nitrogen issue;
 - ii. septic systems as a source of Nitrogen; and

(Part IX.D.1.b)

- iii. Nitrogen concerns with fertilizer use.

2. Public Involvement/ Participation

No additional requirements proposed for at this time.

3. Illicit Discharge Detection and Elimination - applicable to *traditional land use control* and *traditional non-land use control MS4s*

a. Develop and maintain a map showing the entire small MS4 conveyance system. The covered entity shall complete the mapping of approximately 20% of the system every year, with the entire system being mapped by May 1, 2015. At a minimum, the map and/or supportive documentation for the conveyance system shall include the following information:

- i. type of conveyance system - closed pipe or open drainage;
- ii. for closed pipe systems - pipe material, shape, and size;
- iii. for open drainage systems - channel/ditch lining material, shape, and dimensions; location and dimensions of any culvert crossings;
- iv. drop inlet, catch basin, and manhole locations; and
- v. number and size of connections (inlets/outlets) to catch basins and manholes, direction of flow.

All information shall be prepared in digital format suitable for use in GIS software and in accordance with the *Department's* guidance on Illicit Discharge Detection and Elimination. The scale shall be 1:24000 or better.

4. Construction Site Stormwater Runoff Control

No additional requirements at this time.

5. Post-Construction Stormwater Management - applicable to *traditional land use control*, *traditional non-land use control* and *non-traditional MS4s*.

Develop and commence implementation of a Retrofit Program that addresses runoff from sites to correct or reduce existing erosion and/or pollutant loading problems, with a particular emphasis placed on the pollutant Nitrogen. At a minimum, the MS4 shall:

- a. establish procedures to identify sites with erosion and/or pollutant loading problems;

(Part IX.D.5)

- b. establish policy and procedures for project selection. Project selection should be based on the Nitrogen reduction potential of the specific retrofit being constructed/installed; the ability to use standard, proven technologies; and the economic feasibility of constructing/installing the retrofit. As part of the project selection process, the *covered entity* should participate in locally based watershed planning efforts which involve the *Department*, other *covered entities*, stakeholders and other interested parties;
- c. establish policy and procedures for project permitting, design, funding, construction and maintenance; and
- d. by March 9, 2011, develop and submit approvable plans and schedules for completing retrofit projects, including identification of funding sources. Upon DEC approval of those plans and schedules, the plans and schedules shall become enforceable requirements of this permit.

6. Pollution Prevention/Good Housekeeping For Municipal Operations - applicable to *traditional land use control, traditional non-land use control and non-traditional MS4s*.

- a. Develop a turf management practices and procedures policy. The policy should address the following:
 - i. procedures for proper fertilizer application on municipally-owned lands. The application of any Nitrogen-containing fertilizer shall only be allowed under the supervision of a Certified Crop Advisor or Certified Landscape Architect; and
 - ii. the planting of native plant material to lessen the frequency of mowing and reduce the use of chemicals to control vegetation.

Part X. ACRONYMS AND DEFINITIONS

A. Acronym List

BMP - Best Management Practice
CFR - Code of Federal Regulations
CWA - Clean Water Act
ECL - Environmental Conservation Law
MCC - Municipal Compliance Certification
MCM - Minimum Control Measure
MEP - Maximum Extent Practicable
MS4 - Municipal Separate Storm Sewer System
NPDES - National Pollutant Discharge Elimination System
POC - Pollutant of Concern
SPDES - State Pollutant Discharge Elimination System
SWMP - Stormwater Management Program
SWMP Plan - Stormwater Management Program Plan
SWPPP - Stormwater Pollution Prevention Plan
TMDL - Total Maximum Daily Load
UA - Urbanized Area

B. Definitions

Activities - See best management practice

Additionally Designated Areas - EPA required the Department to develop a set of criteria for designating additional MS4 areas as subject to these regulations. The following criteria have been adopted to designate additional MS4s in New York State:

Criteria 1: MS4s discharging to waters for which and EPA-approved TMDL required reduction of a pollutant associated with stormwater beyond what can be achieved with existing programs (and the area is not already covered under automatic designation as UA).

Criteria 2: MS4s contiguous to automatically designated urbanized areas (town lines) that discharge to sensitive waters classified as AA Special (fresh surface waters), AA (fresh surface waters) with filtration avoidance determination or SA (saline surface waters).

Criterion 3: Automatically designated MS4 areas are extended to Town, Village or City boundaries, but only for Town, Village or City implementation of Minimum Control Measures (4) Construction Site Stormwater Runoff Control and (5) Post Construction Stormwater Management in Development and Redevelopment. This additional designation may be waived, by written request to the Department, where the automatically designated area is a small portion of the total area of the Town, Village or City (less than 15 %) and where there is

little or no construction activity in the area outside of the automatically designated area (less than 5 disturbed acres per year).

Best Management Practice - means schedules activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment requirements (if determined necessary by the covered entity), operating procedures, and practices to control runoff, spillage and leaks, sludge or waste disposal, or drainage from areas that could contribute pollutants to stormwater discharges. BMP is referred to in EPA's fact sheets and other materials. BMPs are also referred to as "activities" or "management practices" throughout this *SPDES general permit*.

Better Site Design (BSD) - Better Site Design incorporates non-structural and natural approaches to new and redevelopment projects to reduce impacts on watersheds by conserving natural areas, reducing impervious cover and better integrating stormwater treatment. Better site design is a form of Green Infrastructure and is similar to Low Impact Development (LID). See also Green Infrastructure and Low Impact Development.

Construction Activity(ies) - means any clearing, grading, excavation, demolition or stockpiling activities that result in soil disturbance. Clearing activities can include but are not limited to logging equipment operation, the cutting and skidding of trees, stump removal and/or brush root removal. Construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

Covered entity - means the holder of this *SPDES general permit* or an entity required to gain coverage under this *SPDES general permit*. The owner / operator of the small MS4.

Department - means the New York State Department of Environmental Conservation as well as meaning the Department 's designated agent.

Development - period after initial authorization under this *SPDES general permit* when the covered entity creates, designs or develops activities, BMPs, tasks or other measures to include in their SWMP

Discharge(s) - any addition of any pollutant to waters of the State through an outlet or point source.

Discharge Authorized by a SPDES Permit - means discharges of wastewater or stormwater from sources listed in the permit, that do not violate ECL Section 17-0501, that are through outfalls listed in the permit, and that are:

1. discharges within permit limitations of pollutants limited in the SPDES permit;

2. discharges within permit limitations of pollutants limited by an indicator limit in the SPDES permit;
3. discharges of pollutants subject to action level requirements in the SPDES permit;
4. discharges of pollutants not explicitly listed in the SPDES permit, but reported in the SPDES permit application record as detected in the discharge or as something the covered entity knows or has reason to believe to be present in the discharge, provided the special conditions section of the applicable SPDES permit does not otherwise forbid such a discharge and provided that such discharge does not exceed, by an amount in excess of normal effluent variability, the level of discharge that may reasonably be expected for that pollutant from information provided in the SPDES permit application record;
5. discharges of pollutants not required to be reported on the appropriate and current New York State SPDES permit application; provided the special conditions section of the permit does not otherwise forbid such a discharge. The Department may, in accordance with law and regulation, modify the permit to include limits for any pollutant even if that pollutant is not required to be reported on the SPDES permit application; or
6. discharges from fire fighting activities; fire hydrant flushings; testing of fire fighting equipment, provided that such equipment is for water only fire suppression; potable water sources including waterline flushings; irrigation drainage; lawn watering; uncontaminated infiltration and inflow; leakage from raw water conveyance systems; routine external building washdown and vehicle washing which does not use detergents or other compounds; pavement washwaters where spills or leaks of toxic or hazardous materials, other than minor and routine releases from motor vehicles, have not occurred (unless such material has been removed) and where detergents are not used; air conditioning and steam condensate; springs; uncontaminated groundwater; and foundation or footing drains where flows are not contaminated with process materials such as solvents provided that the covered entity has implemented an effective plan for minimizing the discharge of pollutants from all of the sources listed in this subparagraph.

Environmental Conservation Law - means chapter 43-B of the Consolidated Laws of the State of New York, entitled the Environmental Conservation Law.

Green Infrastructure - Green infrastructure approaches essentially infiltrate, evapotranspire or reuse stormwater, with significant utilization of soils and vegetation rather than traditional hardscape collection, conveyance and storage structures . Common green infrastructure approaches include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains. See also Low Impact Development and Better Site Design.

Groundwater - means waters in the saturated zone. The saturated zone is a subsurface zone in which all the interstices are filled with water under pressure greater than that of the

atmosphere. Although the zone may contain gas-filled interstices or interstices filled with fluids other than water, it is still considered saturated.

Illicit Discharges - discharges not entirely composed of stormwater into the small MS4, except those identified in Part I.A.2. Examples of illicit discharges are non-permitted sanitary sewage, garage drain effluent, and waste motor oil. However, an illicit discharge could be any other non-permitted discharge which the covered entity or Department has determined to be a substantial contributor of pollutants to the small MS4.

Impaired Water - a water is impaired if it does not meet its designated use(s). For purposes of this permit 'impaired' refers to impaired waters for which TMDLs have been established, for which existing controls such as permits are expected to resolve the impairment, and those needing a TMDL. Impaired waters compilations are also sometimes referred to as 303(d) lists; 303(d) lists generally include only waters for which TMDLs have not yet been developed. States will generally have associated, but separate lists of impaired waters for which TMDLs have already been established.

Implementation - period after development of SWMP, where the covered entity puts into effect the practices, tasks and other activities in their SWMP.

Individual SPDES Permit - means a SPDES permit issued to a single facility in one location in accordance with this Part (as distinguished from a *SPDES general permit*).

Industrial Activity - as defined by the SPDES Multi-Sector General Permit (GP-0-12-001).

Larger Common Plan of Development or Sale - means a contiguous area where multiple separate and distinct construction activities are occurring, or will occur, under one plan. The term "plan" in "larger common plan of development or sale" is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, State Environmental Quality Review Act Application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating that construction activities may occur on a specific plot.

For discrete construction projects that are located within a larger common plan of development or sale that are at least 1/4 mile apart, each project can be treated as a separate plan of development or sale provided any interconnecting road, pipeline or utility project that is part of the same "common plan" is not concurrently being disturbed.

Low Impact Development - is a site design strategy with a goal of maintaining or replicating the predevelopment hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic landscape. Hydrologic functions of storage, infiltration,

and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro scale stormwater retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoff time. Other strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands and highly permeable soils. LID principles are based on controlling stormwater at the source by the use of micro scale controls that are distributed throughout the site. This is unlike conventional approaches that typically convey and manage runoff in large facilities located at the base of drainage areas. See also Green Infrastructure and Better Site Design.

Management Practices - See best management practices

Maximum Extent Practicable - is a technology-based standard established by Congress in the Clean Water Act '402(p)(3)(B)(iii). Since no precise definition of MEP exists, it allows for maximum flexibility on the part of MS4 operators as they develop their programs. (40CFR 122.2 See also: Stormwater Phase II Compliance Assistance Guide EPA 833-R-00-002, March 2000). When trying to reduce pollutants to the MEP, there must be a serious attempt to comply, and practical solutions may not be lightly rejected. If a covered entity chooses only a few of the least expensive methods, it is likely that MEP has not been met. On the other hand, if a covered entity employs all applicable BMPs except those where it can be shown that they are not technically feasible in the locality, or whose cost would exceed any benefit to be derived, it would have met the standard. MEP required covered entities to choose effective BMPs, and to reject applicable BMPs only where other effective BMPs will serve the same purpose, the BMPs would not be technically feasible, or the cost would be prohibitive.

Measurable Goals - are the goals of the SWMP that should reflect the needs and characteristics of the covered entity and the areas served by its small MS4. Furthermore, the goals should be chosen using an integrated approach that fully addresses the requirements and intent of the MCM. The assumption is that the program schedules would be created over a 5 year period and goals would be integrated into that time frame. For example, a larger MS4 could do an outfall reconnaissance inventory for 20% of the collection system every year so that every outfall is inspected once within the permit cycle

Municipal / Municipalities - referred to in the federal rule that describes the Phase II stormwater program includes not only the State's municipal governments (cities, towns, villages and counties), but any publicly funded entity that owns or operates a separate storm sewer system. Examples of other public entities that are included in this program include the State Department of Transportation, State University Campuses, federal and State prisons, State and federal hospitals, Thruway and Dormitory Authorities, public housing authorities, school and other special districts.

Municipal Separate Storm Sewer System - a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

1. owned or operated by a State, city, town, village, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA, that discharges to surface waters of the State;
2. designed or used for collecting or conveying stormwater;
3. which is not a combined sewer; and
4. which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

National Pollutant Discharge Elimination System - means the national system for the issuance of wastewater and stormwater permits under the Federal Water Pollution Control Act (Clean Water Act).

Non-traditional MS4s - state and federal prisons, office complexes, hospitals; state: transportation agencies; university campuses, public housing authorities, schools, other special districts.

Open Meetings Law - per Public Officers Law, Article 7, Open Meetings Law, Section 104, Public notice:

1. Public notice of the time and place of a meeting scheduled at least one week prior thereto shall be given to the news media and shall be conspicuously posted in one or more designated public locations at least seventy two hours before such meeting.
2. Public notice of the time and place of every other meeting shall be given, to the extent practicable, to the news media and shall be conspicuously posted in one or more designated public locations at a reasonable time prior thereto.
3. The public notice provided for by this section shall not be construed to require publication as a legal notice.
4. If videoconferencing is used to conduct a meeting, the public notice for the meeting shall inform the public that videoconferencing will be used, identify the locations for the meeting, and state that the public has the right to attend the meeting at any of the locations.

Operator - the person, persons or legal entity that is responsible for the small MS4, as indicated by signing the NOI to gain coverage for the MS4 under this *SPDES general permit*.

Outfall - is defined as any point where a municipally owned and operated separate storm sewer system discharges to either surface waters of the State or to another MS4. Outfalls

include discharges from pipes, ditches, swales, and other points of concentrated flow. However, areas of non-concentrated (sheet) flow which drain to surface waters of the State or to another MS4's system are not considered outfalls and should not be identified as such on the system map.

Pollutants of Concern - there are POCs that are primary (comprise the majority) sources of stormwater pollutants and others that are secondary (less likely).

- The POCs that are primarily of concern are: nitrogen, phosphorus, silt and sediment, pathogens, flow, and floatables impacting impaired waterbodies listed on the Priority Waterbody List known to come in contact with stormwater that could be discharged to that water body.
- The POCs that are secondarily of concern include but are not limited to petroleum hydrocarbons, heavy metals, and polycyclic aromatic hydrocarbons (PAHs), where stormwater or runoff is listed as the source of this impairment.
- The primary and secondary POCs can also impair waters not on the 303(d) list. Thus, it is important for the covered entity to assess known and potential POCs within the area served by their small MS4. This will allow the covered entity to address POCs appropriate to their MS4.

Qualified Professional - means a person that is knowledgeable in the principles and practices of stormwater management and treatment, such as a licensed Professional Engineer, Registered Landscape Architect or other Department endorsed individual(s). Individuals preparing SWPPPs that require the post-construction stormwater management practice component must have an understanding of the principles of hydrology, water quality management practice design, water quantity control design, and, in many cases, the principles of hydraulics in order to prepare a SWPPP that conforms to the Department's technical standard. All components of the SWPPP that involve the practice of engineering, as defined by the NYS Education Law (see Article 145), shall be prepared by, or under the direct supervision of, a professional engineer licensed to practice in the State of New York.

Reporting Date – means the end of the annual reporting period, March 9, as indicated in Part V.C.1.

Retrofit - means modifying or adding to existing infrastructure for the purpose of reducing pollutant loadings. Examples, some of which may not be effective for all pollutants, include:

Better site design approaches such as roof top disconnection, diversion of runoff to infiltration areas, soil de-compaction, riparian buffers, rain gardens, cisterns

Rehabilitation of existing storm sewer system by installation of standard stormwater treatment systems (ponds, wetlands, filtering, infiltration) or proprietary practices

Stabilize dirt roads (gravel, stone, water bar, check dam, diversion)

Conversion of dirt parking lots to pervious pavement, grassed or stone cover

Conversion of dry detention ponds to extended detention or wetland treatment systems

Retrofit by converting abandoned buildings to stormwater treatment systems

Retrofit of abandoned building to open space

Retrofit road ditches to enhance open channel design

Control the downstream effects of runoff from existing paved surfaces resulting in flooding and erosion in receiving waters

Control stream erosion by plunge pool, velocity dissipaters, and flow control devices for discharges from conveyance systems

Upgrade of an existing conveyance system to provide water quality and /or quantity control within the drainage structure

Section 303(d) Listed Waters - Section 303(d) is part of the federal CWA that requires the Department to periodically to prepare a list of all surface waters in the State for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality-limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years. Refer to impaired waters for more information.

Single entity - An entity, formed in accordance with the applicable state and/or local legislation, with a legal authority and capacity (financial, resources, etc...) that gains coverage under the MS4 general permit to implement all or parts of the MS4 program within a jurisdiction on behalf of multiple MS4s in that geographic area.

Small MS4 - MS4 system within an urbanized area or other areas designated by the State.

SPDES general permit - means a SPDES permit issued pursuant to 6 NYCRR Part 750-1.21 authorizing a category of discharges.

Staff - actual employees of the covered entity or contracted entity.

State - means the State of New York.

State Pollutant Discharge Elimination System - means the system established pursuant to Article 17 of the ECL and 6 NYCRR Part 750 for issuance of permits authorizing discharges to the waters of the state.

Stormwater - means that portion of precipitation that, once having fallen to the ground, is in excess of the evaporative or infiltrative capacity of soils, or the retentive capacity of surface features, which flows or will flow off the land by surface runoff to waters of the state.

Stormwater Management Program - the program implemented by the covered entity. Covered entities are required at a minimum to develop, implement and enforce a SWMP designed to address POCs and reduce the discharge of pollutants from the small MS4 to the MEP, to protect water quality, and to satisfy the appropriate water quality requirements of the *ECL* and Clean Water Act. The SWMP must address the MCM described in Part VIII.

The *SWMP* needs to include *measurable goals* for each of the *BMPs*. The measurable goals will help the covered entities assess the status and progress of their program. The SWMP should:

1. describe the BMP / measureable goal;
2. identify time lines / schedules and milestones for development and implementation;
3. include quantifiable goals to assess progress over time; and
4. describe how the covered entity will address POCs.

Guidance on developing SWMPs is available from the Department on its website. Examples of successful SWMPs and suggested measurable goals are also provided in EPA's Menu of BMPs available from its website. Note that this information is for guidance purposes only. An MS4 may choose to develop or implement equivalent methods equivalent to those made available by the Department and EPA to demonstrate compliance with the MCMs.

When creating the *SWMP*, the *covered entities* should assess activities already being performed that could help meet, or be modified to meet, permit requirements and be included in the *SWMP*. *Covered entities* can create their *SWMP* individually, with a group of other individual *covered entities* or a coalition of *covered entities*, or through the work of a third party entity.

Stormwater Management Program Plan- used by the covered entity to document developed, planned and implemented SWMP elements. The *SWMP plan* must describe how pollutants in stormwater runoff will be controlled. For previously unauthorized *small MS4s* seeking coverage, information included in the NOI should be obtained from the *SWMP plan*.

The *SWMP plan* is a separate document from the NOI and should not be submitted with the NOI or any annual reports unless requested.

The *SWMP plan* should include a detailed written explanation of all management practices, activities and other techniques the covered entity has developed, planned and implemented for their SWMP to address POCs and reduce pollutant discharges from their small MS4 to the MEP. The *SWMP plan* shall be revised to incorporate any new or modified *BMPs* or *measurable goals*.

Covered entities can create their *SWMP plan* individually, with a group of other individual *covered entities* or a coalition of *covered entities*, or through the work of a third party entity.

Documents to include are: applicable local laws, inter-municipal agreements and other legal authorities; staffing and staff development programs and organization charts; program budget; policy, procedures, and materials for each minimum measure; outfall and small MS4 system maps; stormwater management practice selection and measurable goals; operation and maintenance schedules; documentation of public outreach efforts and public comments; submitted construction site SWPPPs and review letters and construction site inspection reports.

The *SWMP plan* shall be made readily available to the covered entity's staff and to the public and regulators, such as *Department* and EPA staff. Portions of the *SWMP plan*, primarily policies and procedures, must be available to the management and staff of a *covered entity* that will be called upon to use them. For example, the technical standards and associated technical assistance documents and manuals for stormwater controls should be available to code enforcement officers, review engineers and planning boards. The local laws should be readily available to the town board and planning board. An integrated pest management program would have to be available to the parks department and the stormwater outfall and available sewer system mapping and catch basin cleaning schedule would have to be available to the department of public works.

Storm sewershed - the catchment area that drains into the storm sewer system based on the surface topography in the area served by the stormsewer. Adjacent catchment areas that drain to adjacent outfalls are not separate storm sewersheds.

Surface Waters of the State - shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic ocean within the territorial seas of the state of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction. Waters of the state are further defined in 6 NYCRR Parts 800 to 941.

Storm sewers are not waters of the state unless they are classified in 6 NYCRR Parts 800 to 941. Nonetheless, a discharge to a storm sewer shall be regulated as a discharge at the point where the storm sewer discharges to waters of the state. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Act and Environmental Conservation Law (other than cooling ponds as defined in 40 CFR 423.11(m)(see section 750 - 1.24) which also meet the criteria of this definition are not waters of the state. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the State (such as a disposal area in wetlands) nor resulted from impoundment of waters of the state.

SWPPP - as defined per the NYS DEC SPDES General Permit for Stormwater Discharges from Construction Activity or NYS DEC SPDES Multi-Sector General Permit for Stormwater Associated with Industrial Activity .

Total Maximum Daily Load - A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. It is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL stipulates wasteload allocations for point source discharges, load allocations for nonpoint sources, and a margin of safety.

Traditional Land Use Control MS4s - means a city, town or village with land use control authority.

Traditional Non-land Use Control MS4s - means any county agency without land use control.

Urbanized Area - is a land area comprising one or more places (central place(s)) and the adjacent densely settled surrounding area (urban fringe) that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile, as defined by the US Bureau of Census. Outlines the extent of automatically regulated areas, often do not extend to the political boundaries of a city, town, or village. SWMPs are only required within the UA. However, the Department encourages covered entities to voluntarily extend their SWMP programs at least to the extent of the storm sewershed that flows into the UA or extend further to their entire jurisdiction. For ease of creation and administration of local laws, ordinances or other regulatory mechanisms, these should be created to apply to the full jurisdictional boundary of municipalities.

Water Quality Standard - means such measures of purity or quality for any waters in relation to their reasonable and necessary use as promulgated in 6 NYCRR Part 700 et seq.

Part XI. RE-OPENER CLAUSE

If there is evidence indicating that the stormwater discharges authorized by this permit cause or have the reasonable potential to cause or contribute to a violation of a water quality standard, the covered entity may be required at the Department's sole discretion to obtain an individual SPDES permit or an alternative *SPDES general permit* or the permit may be modified. In addition, coverage under this permit could terminate, meaning the discharge must cease.

APPENDICES

APPENDIX 1. LIST OF NYS DEC REGIONAL OFFICES

<u>Region</u>	<u>COVERING THE FOLLOWING COUNTIES:</u>	<u>DIVISION OF ENVIRONMENTAL PERMITS (DEP) PERMIT ADMINISTRATORS</u>	<u>DIVISION OF WATER (DOW) WATER (SPDES) PROGRAM</u>
1	NASSAU AND SUFFOLK	50 CIRCLE ROAD STONY BROOK, NY 11790 TEL. (631) 444-0365	50 CIRCLE ROAD STONY BROOK, NY 11790-3409 TEL. (631) 444-0405
2	BRONX, KINGS, NEW YORK, QUEENS AND RICHMOND	1 HUNTERS POINT PLAZA, 47-40 21ST ST. LONG ISLAND CITY, NY 11101-5407 TEL. (718) 482-4997	1 HUNTERS POINT PLAZA, 47-40 21ST ST. LONG ISLAND CITY, NY 11101-5407 TEL. (718) 482-4933
3	DUTCHESS, ORANGE, PUTNAM, ROCKLAND, SULLIVAN, ULSTER AND WESTCHESTER	21 SOUTH PUTT CORNERS ROAD NEW PALTZ, NY 12561-1696 TEL. (845) 256-3059	100 HILLSIDE AVENUE, SUITE 1W WHITE PLAINS, NY 10603 TEL. (914) 428 - 2505
4	ALBANY, COLUMBIA, DELAWARE, GREENE, MONTGOMERY, OTSEGO, RENSSELAER, SCHENECTADY AND SCHOHARIE	1150 NORTH WESTCOTT ROAD SCHENECTADY, NY 12306-2014 TEL. (518) 357-2069	1130 NORTH WESTCOTT ROAD SCHENECTADY, NY 12306-2014 TEL. (518) 357-2045
5	CLINTON, ESSEX, FRANKLIN, FULTON, HAMILTON, SARATOGA, WARREN AND WASHINGTON	1115 STATE ROUTE 86, PO BOX 296 RAY BROOK, NY 12977-0296 TEL. (518) 897-1234	232 GOLF COURSE ROAD, PO BOX 220 WARRENSBURG, NY 12885-0220 TEL. (518) 623-1200
6	HERKIMER, JEFFERSON, LEWIS, ONEIDA AND ST. LAWRENCE	STATE OFFICE BUILDING 317 WASHINGTON STREET WATERTOWN, NY 13601-3787 TEL. (315) 785-2245	STATE OFFICE BUILDING 207 GENESEE STREET UTICA, NY 13501-2885 TEL. (315) 793-2554
7	BROOME, CAYUGA, CHENANGO, CORTLAND, MADISON, ONONDAGA, OSWEGO, TIOGA AND TOMPKINS	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7438	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7500
8	CHEMUNG, GENESEE, LIVINGSTON, MONROE, ONTARIO, ORLEANS, SCHUYLER, SENECA, STEUBEN, WAYNE AND YATES	6274 EAST AVON-LIMA ROAD AVON, NY 14414-9519 TEL. (585) 226-2466	6274 EAST AVON-LIMA RD. AVON, NY 14414-9519 TEL. (585) 226-2466
9	ALLEGANY, CATTARAUGUS, CHAUTAUQUA, ERIE, NIAGARA AND WYOMING	270 MICHIGAN AVENUE BUFFALO, NY 14203-2999 TEL. (716) 851-7165	270 MICHIGAN AVE. BUFFALO, NY 14203-2999 TEL. (716) 851-7070

APPENDIX 2. IMPAIRED SEGMENTS AND PRIMARY POLLUTANTS OF CONCERN

**APPENDIX 2 (CONTINUED)
IMPAIRED SEGMENTS AND SECONDARY POLLUTANTS OF CONCERN**

COUNTY	WATERBODY NAME	POLLUTANT
Albany	Ann Lee (Shakers) Pond, Stump Pond	phosphorus
Albany	Basic Creek Reservoir	phosphorus
Bronx	Van Cortlandt Lake	phosphorus
Bronx	Bronx River, Lower	pathogens
Bronx	Bronx River, Lower	floatables
Bronx	Bronx River, Middle, and tribs	pathogens
Bronx	Bronx River, Middle, and tribs	floatables
Bronx	Westchester Creek	floatables
Bronx	Hutchinson River, Lower, and tribs	Floatables
Broome	Susquehanna River, Lower, Main Stem	Pathogens
Broome	Whitney Point Lake/Reservoir	phosphorus
Broome	Park Creek and tribs	pathogens
Broome	Beaver Lake	phosphorus
Broome	White Birch Lake	phosphorus
Cayuga	Little Sodus Bay	phosphorus
Cayuga	Owasco Lake	pathogens
Cayuga, Tompkins	Owasco Inlet, Upper, and tribs	phosphorus
Chautauqua	Lake Erie (Dunkirk Harbor)	pathogens
Chautauqua	Chadakoin River and tribs	phosphorus
Chautauqua	Chautauqua Lake, South	phosphorus
Chautauqua	Chautauqua Lake, North	phosphorus
Chautauqua	Bear Lake	phosphorus
Chautauqua	Lower Cassadaga Lake	phosphorus
Chautauqua	Middle Cassadaga Lake	phosphorus
Chautauqua	Findley Lake	phosphorus
Chenango	Unadilla River, Lower, Main Stem	pathogens
Clinton	Lake Champlain, Main Lake, North	phosphorus
Clinton	Lake Champlain, Main Lake, Middle	phosphorus
Clinton	Great Chazy River, Lower, Main Stem	silt/sediment
Columbia	Robinson Pond	phosphorus
Columbia	Kinderhook Lake	phosphorus
Delaware	Cannonsville Reservoir	phosphorus
Dutchess	Hillside Lake	phosphorus
Dutchess	Wappinger Lakes	phosphorus
Dutchess	Wappinger Lakes	silt/sediment
Dutchess	Fall Kill and tribs	phosphorus
Dutchess	Rudd Pond	phosphorus

COUNTY	WATERBODY NAME	POLLUTANT
Erie	Ellicott Creek, Lower, and tribs	phosphorus
Erie	Ellicott Creek, Lower, and tribs	silt/sediment
Erie	Ransom Creek, Lower, and tribs	pathogens
Erie	Ransom Creek, Upper, and tribs	pathogens
Erie	Beeman Creek and tribs	phosphorus
Erie	Beeman Creek and tribs	pathogens
Erie	Murder Creek, Lower, and tribs	phosphorus
Erie	Murder Creek, Lower, and tribs	pathogens
Erie	Two Mile Creek and tribs	pathogens
Erie	Two Mile Creek and tribs	floatables
Erie	Scajaquada Creek, Lower, and tribs	floatables
Erie	Scajaquada Creek, Lower, and tribs	pathogens
Erie	South Branch Smoke Cr, Lower, and tribs	phosphorus
Erie	South Branch Smoke Cr, Lower, and tribs	silt/sediment
Erie	Rush Creek and tribs	pathogens
Erie	Rush Creek and tribs	phosphorus
Erie	Little Sister Creek, Lower, and tribs	phosphorus
Erie	Little Sister Creek, Lower, and tribs	pathogens
Essex	Lake Champlain, Main Lake, South	phosphorus
Essex	Lake Champlain, South Lake	phosphorus
Genesee	Tonawanda Creek, Middle, Main Stem	phosphorus
Genesee	Tonawanda Creek, Middle, Main Stem	silt/sediment
Genesee	Tonawanda Creek, Upper, and minor tribs	silt/sediment
Genesee	Bowen Brook and tribs	phosphorus
Genesee	Little Tonawanda Creek, Lower, and tribs	silt/sediment
Genesee	Oak Orchard Cr, Upper, and tribs	phosphorus
Genesee	Black Creek, Upper, and minor tribs	phosphorus
Genesee	Bigelow Creek and tribs	phosphorus
Greene	Schoharie Reservoir	silt/sediment
Greene	Shingle Kill and tribs	pathogens
Greene	Sleepy Hollow Lake	silt/sediment
Herkimer	Unadilla River, Middle, and minor tribs	pathogens
Herkimer	Mohawk River, Main Stem	pathogens
Herkimer	Mohawk River, Main Stem	floatables
Herkimer	Steele Creek tribs	phosphorus
Herkimer	Steele Creek tribs	silt/sediment
Jefferson	Moon Lake	phosphorus
Kings	Coney Island Creek	pathogens
Kings	Coney Island Creek	floatables
Kings	Gowanus Canal	floatables
Kings	Hendrix Creek	nitrogen
Kings	Hendrix Creek	pathogens

COUNTY	WATERBODY NAME	POLLUTANT
Kings	Hendrix Creek	floatables
Kings	Paerdegat Basin	floatables
Kings	Mill Basin and tidal tribs	floatables
Lewis	Beaver River, Lower, and tribs	pathogens
Lewis	Beaver River, Lower, and tribs	floatables
Lewis	Mill Creek/South Branch, and tribs	phosphorus
Lewis	Mill Creek/South Branch, and tribs	pathogens
Livingston	Conesus Lake	phosphorus
Livingston	Jaycox Creek and tribs	phosphorus
Livingston	Jaycox Creek and tribs	silt/sediment
Livingston	Mill Creek and minor tribs	silt/sediment
Madison	Canastota Creek, Lower, and tribs	pathogens
Monroe	Rochester Embayment - West	pathogens
Monroe	Mill Creek and tribs	phosphorus
Monroe	Mill Creek and tribs	pathogens
Monroe	Shipbuilders Creek and tribs	phosphorus
Monroe	Shipbuilders Creek and tribs	pathogens
Monroe	Minor Tribs to Irondequoit Bay	phosphorus
Monroe	Minor Tribs to Irondequoit Bay	pathogens
Monroe	Thomas Creek/White Brook and tribs	phosphorus
Monroe	Buck Pond	phosphorus
Monroe	Long Pond	phosphorus
Monroe	Cranberry Pond	phosphorus
Monroe	Genesee River, Lower, Main Stem	phosphorus
Monroe	Genesee River, Lower, Main Stem	pathogens
Monroe	Genesee River, Lower, Main Stem	silt/sediment
Monroe	Genesee River, Middle, Main Stem	phosphorus
Monroe	Black Creek, Lower, and minor tribs	phosphorus
Nassau	Long Island Sound, Nassau County	pathogens
Nassau	Long Island Sound, Nassau County	nitrogen
Nassau	Manhasset Bay, and tidal tribs	pathogens
Nassau	Manhasset Bay, and tidal tribs	pathogens
Nassau	Hempstead Harbor, south, and tidal tribs	pathogens
Nassau	Glen Cove Creek, Lower, and tribs	pathogens
Nassau	Glen Cove Creek, Lower, and tribs	silt/sediment
Nassau	Dosoris Pond	pathogens
Nassau	Mill Neck Creek and tidal tribs	pathogens
Nassau	South Oyster Bay	pathogens
Nassau	East Bay	pathogens
Nassau	LI Tribs (fresh) to East Bay	phosphorus
Nassau	LI Tribs (fresh) to East Bay	silt/sediment
Nassau	Middle Bay	pathogens

COUNTY	WATERBODY NAME	POLLUTANT
Nassau	East Rockaway Inlet	pathogens
Nassau	Reynolds Channel, east	pathogens
Nassau	East Meadow Brook, Upper, and tribs	silt/sediment
Nassau	Hempstead Bay	Nitrogen
Nassau	Hempstead Bay	Pathogens
Nassau	Hempstead Lake	Phosphorus
Nassau	Grant Park Pond	Phosphorus
Nassau	Woodmere Channel	Pathogens
New York	East River, Lower	Floatables
New York	Harlem River	Floatables
Niagara	Bergholtz Creek and tribs	Phosphorus
Niagara	Bergholtz Creek and tribs	Pathogens
Oneida	Utica Harbor	Pathogens
Oneida	Utica Harbor	Floatables
Oneida	Mohawk River, Main Stem	Pathogens
Oneida	Mohawk River, Main Stem	Floatables
Oneida	Mohawk River, Main Stem	Pathogens
Oneida	Mohawk River, Main Stem	Floatables
Oneida	Ballou, Nail Creeks and tribs	Phosphorus
Oneida	Ninemile Creek, Lower, and tribs	Pathogens
Onondaga	Limestone Creek, Lower, and minor tribs	Pathogens
Onondaga	Seneca River, Lower, Main Stem	Pathogens
Onondaga	Onondaga Lake, northern end	Phosphorus
Onondaga	Onondaga Lake, southern end	pathogens
Onondaga	Onondaga Lake, southern end	phosphorus
Onondaga	Minor Tribs to Onondaga Lake	phosphorus
Onondaga	Minor Tribs to Onondaga Lake	pathogens
Onondaga	Bloody Brook and tribs	pathogens
Onondaga	Ley Creek and tribs	pathogens
Onondaga	Ley Creek and tribs	phosphorus
Onondaga	Onondaga Creek, Lower, and tribs	phosphorus
Onondaga	Onondaga Creek, Lower, and tribs	pathogens
Onondaga	Onondaga Creek, Middle, and tribs	silt/sediment
Onondaga	Onondaga Creek, Middle, and tribs	phosphorus
Onondaga	Onondaga Creek, Middle, and tribs	pathogens
Onondaga	Onondaga Creek, Upper, and minor tribs	silt/sediment
Onondaga	Harbor Brook, Lower, and tribs	phosphorus
Onondaga	Harbor Brook, Lower, and tribs	pathogens
Onondaga	Ninemile Creek, Lower, and tribs	phosphorus
Onondaga	Ninemile Creek, Lower, and tribs	pathogens
Ontario	Hemlock Lake Outlet and minor tribs	phosphorus
Ontario	Hemlock Lake Outlet and minor tribs	pathogens

COUNTY	WATERBODY NAME	POLLUTANT
Ontario	Honeoye Lake	phosphorus
Ontario	Great Brook and minor tribs	phosphorus
Ontario	Great Brook and minor tribs	silt/sediment
Orange	Greenwood Lake	phosphorus
Oswego	Lake Neatahwanta	phosphorus
Otsego	Susquehanna River, Main Stem	pathogens
Putnam	Croton Falls Reservoir	phosphorus
Putnam	West Branch Reservoir	phosphorus
Putnam	Boyd Corners Reservoir	phosphorus
Putnam	Middle Branch Reservoir	phosphorus
Putnam	Lake Carmel	phosphorus
Putnam	Diverting Reservoir	phosphorus
Putnam	East Branch Reservoir	phosphorus
Putnam	Bog Brook Reservoir	phosphorus
Putnam	Oscawana Lake	phosphorus
Queens	Newtown Creek and tidal tribs	floatables
Queens	East River, Upper	floatables
Queens	East River, Upper	floatables
Queens	Flushing Creek/Bay	nitrogen
Queens	Flushing Creek/Bay	floatables
Queens	Little Neck Bay	pathogens
Queens	Alley Creek/Little Neck Bay Trib	floatables
Queens	Jamaica Bay, Eastern, and tribs	nitrogen
Queens	Jamaica Bay, Eastern, and tribs	pathogens
Queens	Jamaica Bay, Eastern, and tribs	floatables
Queens	Thurston Basin	floatables
Queens	Bergen Basin	Nitrogen
Queens	Bergen Basin	pathogens
Queens	Bergen Basin	floatables
Queens	Shellbank Basin	nitrogen
Queens	Spring Creek and tribs	pathogens
Queens	Spring Creek and tribs	floatables
Rensselaer	Snyders Lake	phosphorus
Richmond	Raritan Bay (Class SA)	pathogens
Richmond	Arthur Kill (Class I) and minor tribs	floatables
Richmond	Newark Bay	floatables
Richmond	Kill Van Kull	floatables
Richmond	Grasmere, Arbutus and Wolfes Lakes	phosphorus
Saratoga	Dwaas Kill and tribs	Phosphorus
Saratoga	Dwaas Kill and tribs	silt/sediment
Saratoga	Schuyler Creek and tribs	phosphorus
Saratoga	Schuyler Creek and tribs	pathogens

COUNTY	WATERBODY NAME	POLLUTANT
Saratoga	Lake Lonely	phosphorus
Saratoga	Tribs to Lake Lonely	Phosphorus
Saratoga	Tribs to Lake Lonely	pathogens
Schenectady	Collins Lake	phosphorus
Schoharie	Cobleskill Creek, Lower, and tribs	pathogens
Schoharie	Engleville Pond	phosphorus
Schoharie	Summit Lake	phosphorus
St.Lawrence	Black Lake Outlet/Black Lake	phosphorus
Steuben	Lake Salubria	phosphorus
Steuben	Smith Pond	phosphorus
Suffolk	Millers Pond	phosphorus
Suffolk	Beach/Island Ponds, Fishers Island	pathogens
Suffolk	Dering Harbor	pathogens
Suffolk	Tidal Tribs to Gr Peconic Bay, Northshr	pathogens
Suffolk	Mattituck (Marratooka) Pond	phosphorus
Suffolk	Mattituck (Marratooka) Pond	pathogens
Suffolk	Flanders Bay, West/Lower Sawmill	nitrogen
Suffolk	Meetinghouse/Terrys Creeks and tribs	nitrogen
Suffolk	Meetinghouse/Terrys Creeks and tribs	pathogens
Suffolk	Peconic River, Lower, and tidal tribs	nitrogen
Suffolk	Peconic River, Lower, and tidal tribs	pathogens
Suffolk	Scallop Pond	pathogens
Suffolk	Oyster Pond/Lake Munchogue	pathogens
Suffolk	Phillips Creek, Lower, and tidal tribs	pathogens
Suffolk	Quogue Canal	pathogens
Suffolk	Forge River, Lower and Cove	pathogens
Suffolk	Tidal tribs to West Moriches Bay	Nitrogen
Suffolk	Tidal tribs to West Moriches Bay	pathogens
Suffolk	Canaan Lake	silt/sediment
Suffolk	Canaan Lake	phosphorus
Suffolk	Nicoll Bay	pathogens
Suffolk	Lake Ronkonkoma	phosphorus
Suffolk	Lake Ronkonkoma	pathogens
Suffolk	Great Cove	pathogens
Tompkins	Cayuga Lake, Southern End	phosphorus
Tompkins	Cayuga Lake, Southern End	silt/sediment
Tompkins	Cayuga Lake, Southern End	pathogens
Ulster	Ashokan Reservoir	silt/sediment
Ulster	Esopus Creek, Upper, and minor tribs	silt/sediment
Warren	Lake George	silt/sediment
Warren	Tribs to L.George, Village of L George	silt/sediment
Warren	Huddle/Finkle Brooks and tribs	silt/sediment

COUNTY	WATERBODY NAME	POLLUTANT
Warren	Indian Brook and tribs	silt/sediment
Warren	Hague Brook and tribs	silt/sediment
Washington	Lake Champlain, South Bay	phosphorus
Washington	Tribs to L.George, East Shore	silt/sediment
Washington	Cossayuna Lake	phosphorus
Wayne	Blind Sodus Bay	phosphorus
Wayne	Port Bay	phosphorus
Westchester	Saw Mill River, Lower, and tribs	floatables
Westchester	New Croton Reservoir	phosphorus
Westchester	Upper New Croton/Muscoot Reservoir	phosphorus
Westchester	Amawalk Reservoir	phosphorus
Westchester	Lake Lincolndale	phosphorus
Westchester	Peach Lake	pathogens
Westchester	Peach Lake	phosphorus
Westchester	Titicus Reservoir	phosphorus
Westchester	Cross River Reservoir	phosphorus
Westchester	Lake Meahaugh	phosphorus
Westchester	Bronx River, Upper, and tribs	pathogens
Westchester	New Rochelle Harbor	pathogens
Westchester	New Rochelle Harbor	floatables
Westchester	Long Island Sound, Westchester Co	pathogens
Westchester	Long Island Sound, Westchester Co	nitrogen
Westchester	Larchmont Harbor	pathogens
Westchester	Larchmont Harbor	floatables
Westchester	Hutchinson River, Middle, and tribs	pathogens
Westchester	Mamaroneck Harbor	pathogens
Westchester	Mamaroneck Harbor	floatables
Westchester	Mamaroneck River, Lower	silt/sediment
Westchester	Mamaroneck River, Upper, and minor	silt/sediment
Westchester	Sheldrake River and tribs	phosphorus
Westchester	Sheldrake River and tribs	silt/sediment
Westchester	Milton Harbor	pathogens
Westchester	Milton Harbor	floatables
Westchester	Blind Brook, Lower	silt/sediment
Westchester	Blind Brook, Upper, and tribs	silt/sediment
Westchester	Port Chester Harbor	pathogens
Westchester	Port Chester Harbor	floatables
Westchester	Byram River, Lower	pathogens
Wyoming	Java Lake	phosphorus
Wyoming	Silver Lake	phosphorus
Oneida	Mohawk River, Main Stem	Copper
Westchester	Hutchinson River, Middle and tribs	Oil and Grease

**APPENDIX 3. NEW YORK CITY WATERSHED EAST OF THE HUDSON RIVER
WATERSHED MAP**

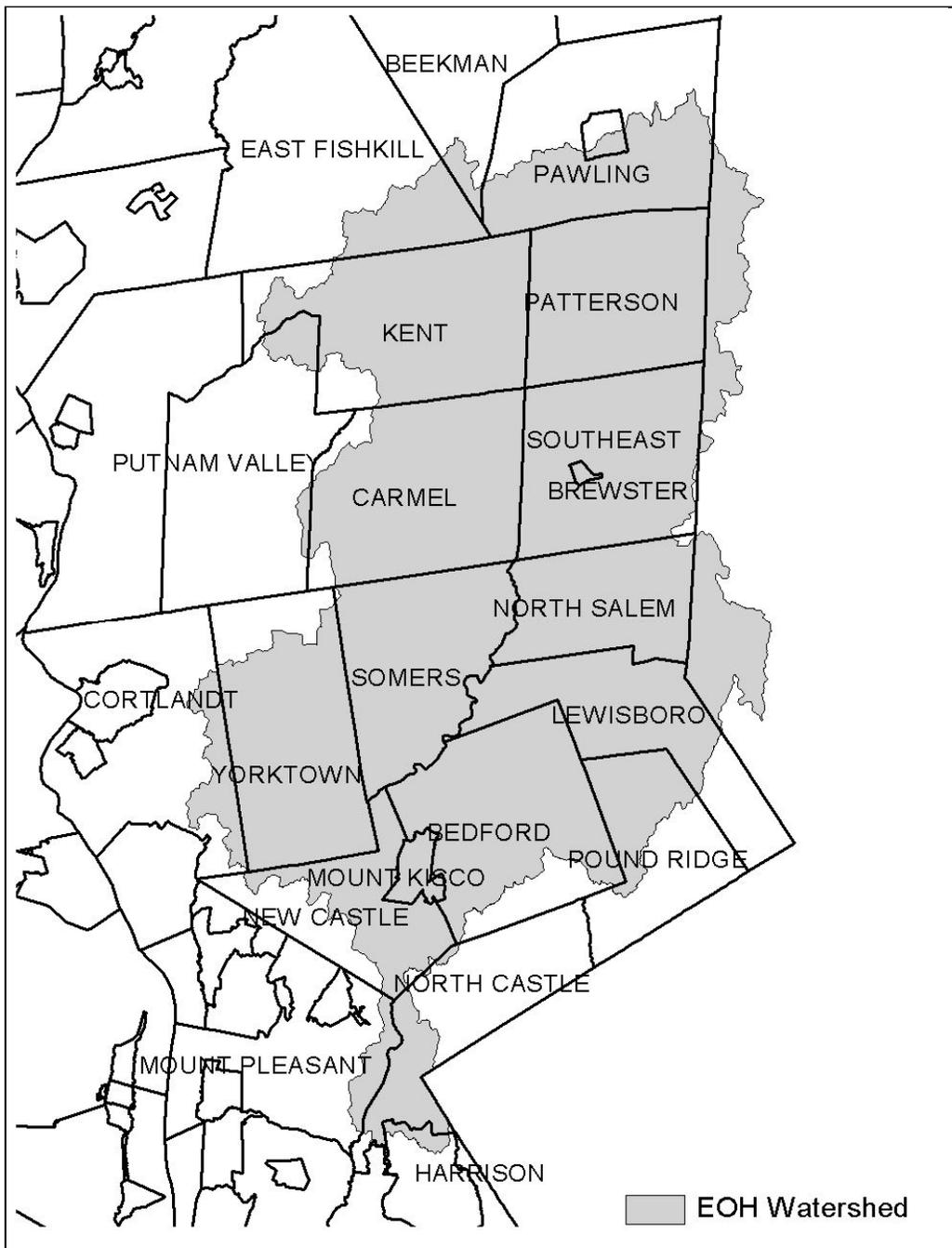


Figure 1. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 4. ONONDAGA LAKE WATERSHED MAP



Figure 2. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 5. GREENWOOD LAKE WATERSHED MAP

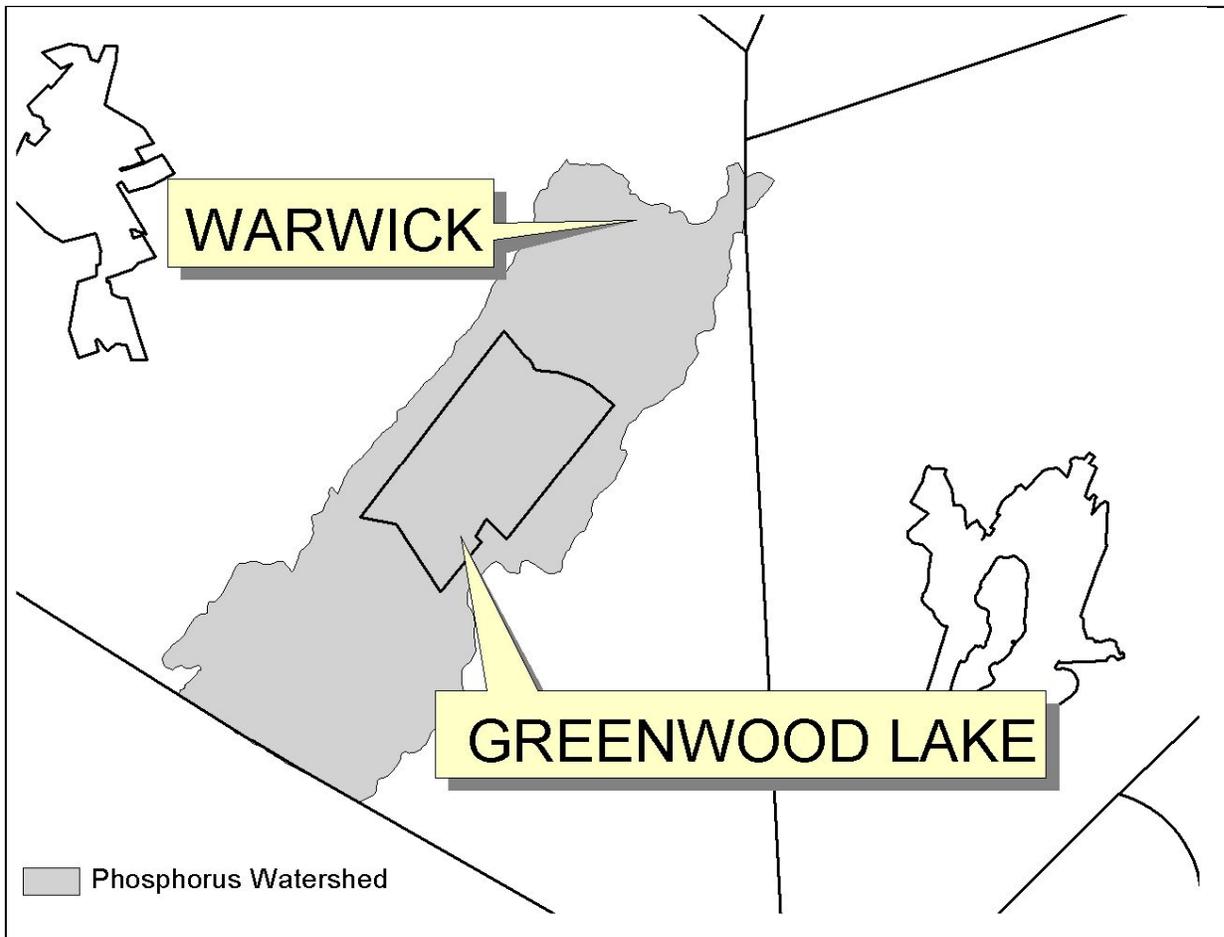


Figure 3. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 6. OYSTER BAY WATERSHED MAP

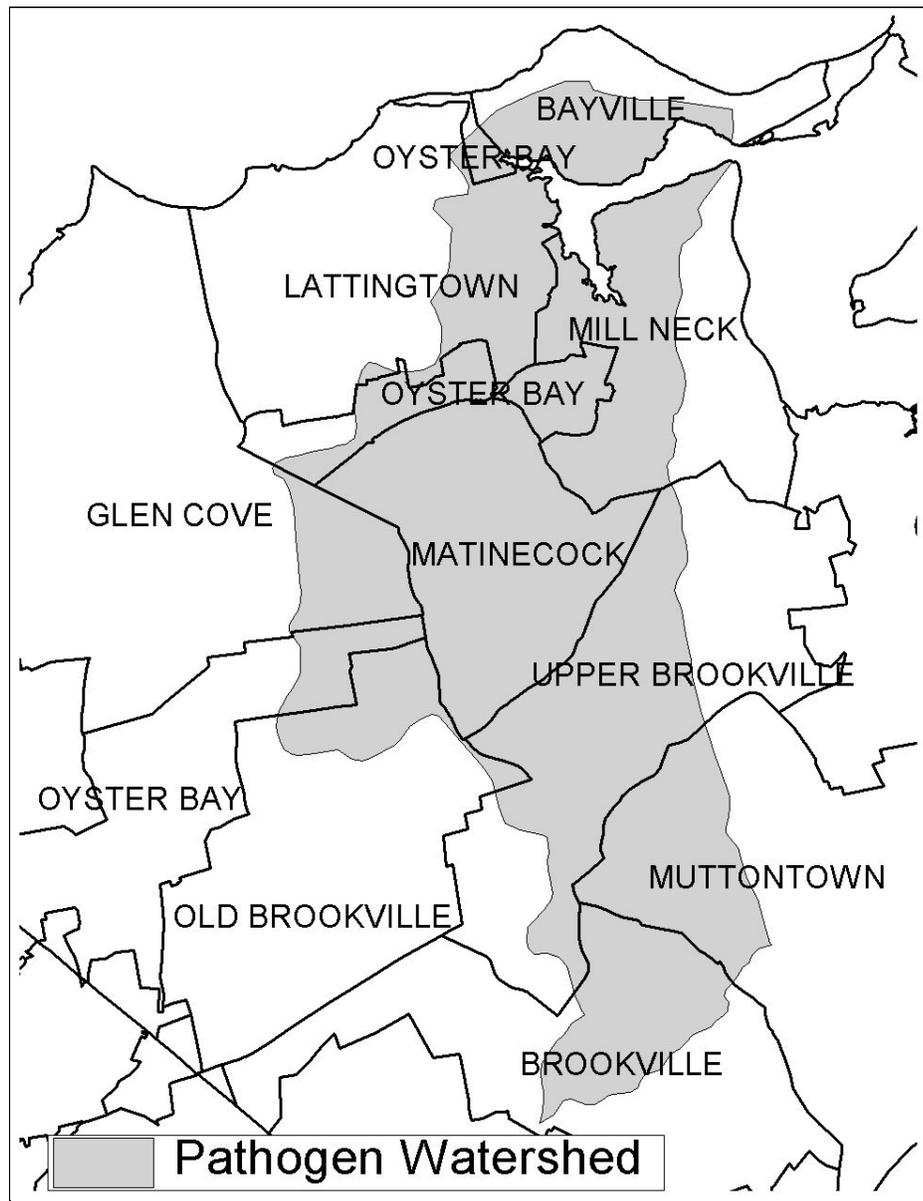


Figure 4. The requirements of watershed improvement strategies apply to the sewer sheds within the shaded areas.

APPENDIX 7. PECONIC ESTUARY PATHOGEN WATERSHED MAP

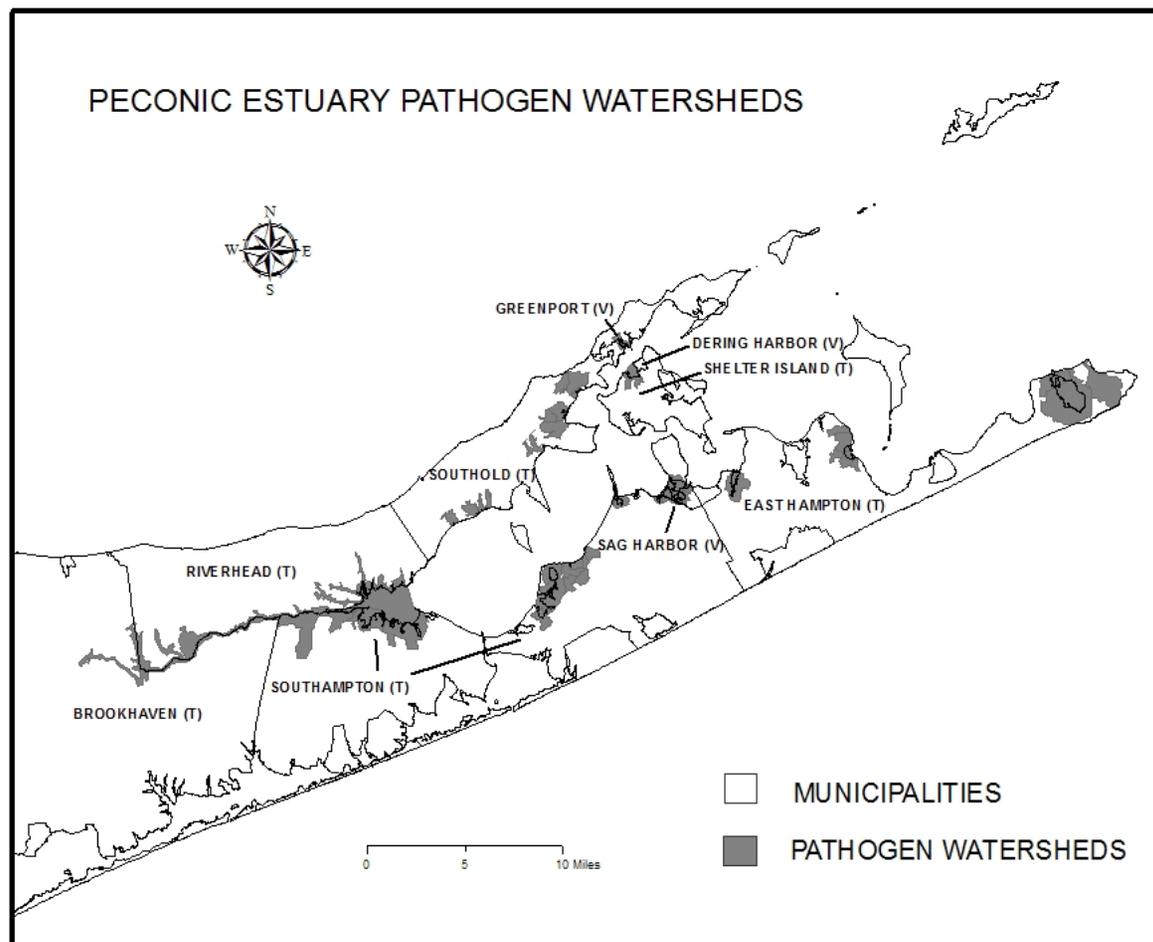


Figure 5. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 8. PECONIC ESTUARY NITROGEN WATERSHED MAP

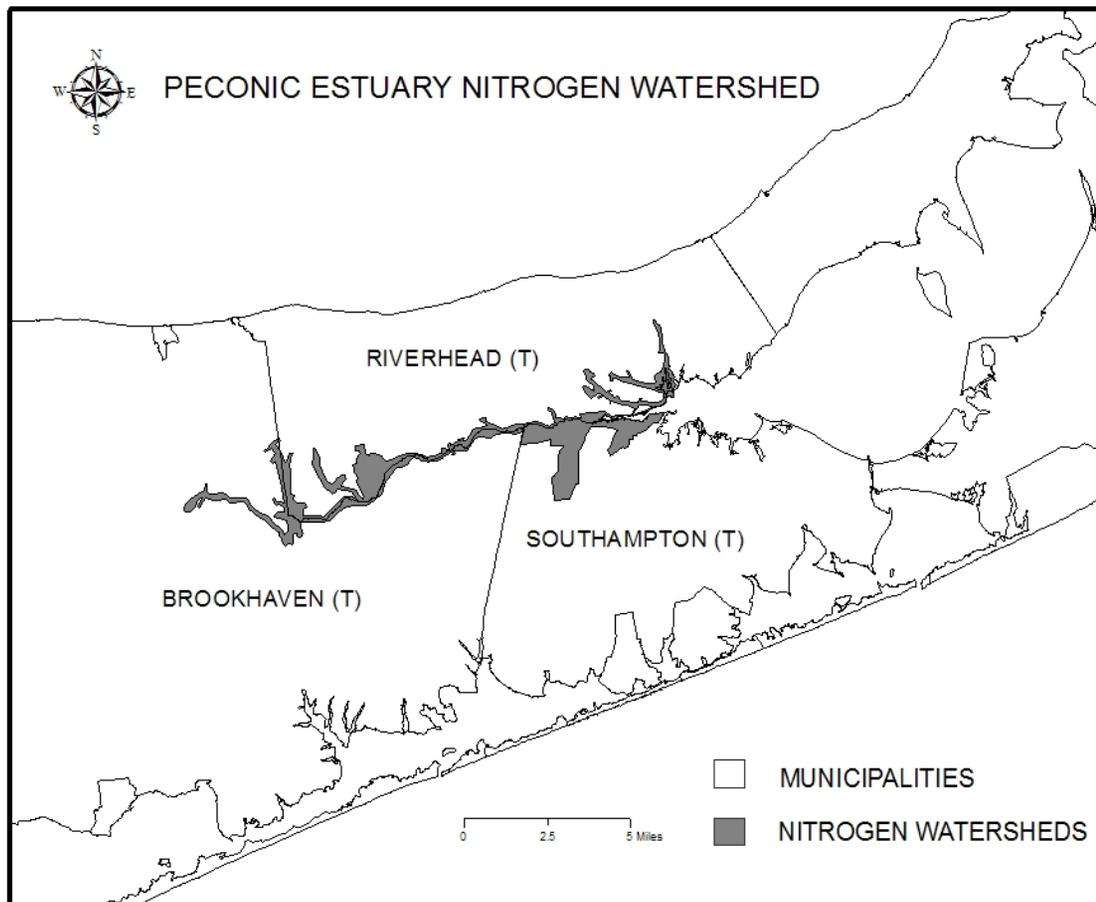


Figure 6. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 9. THE 27 LONG ISLAND SHELLFISHING IMPAIRED EMBAYMENT MAP

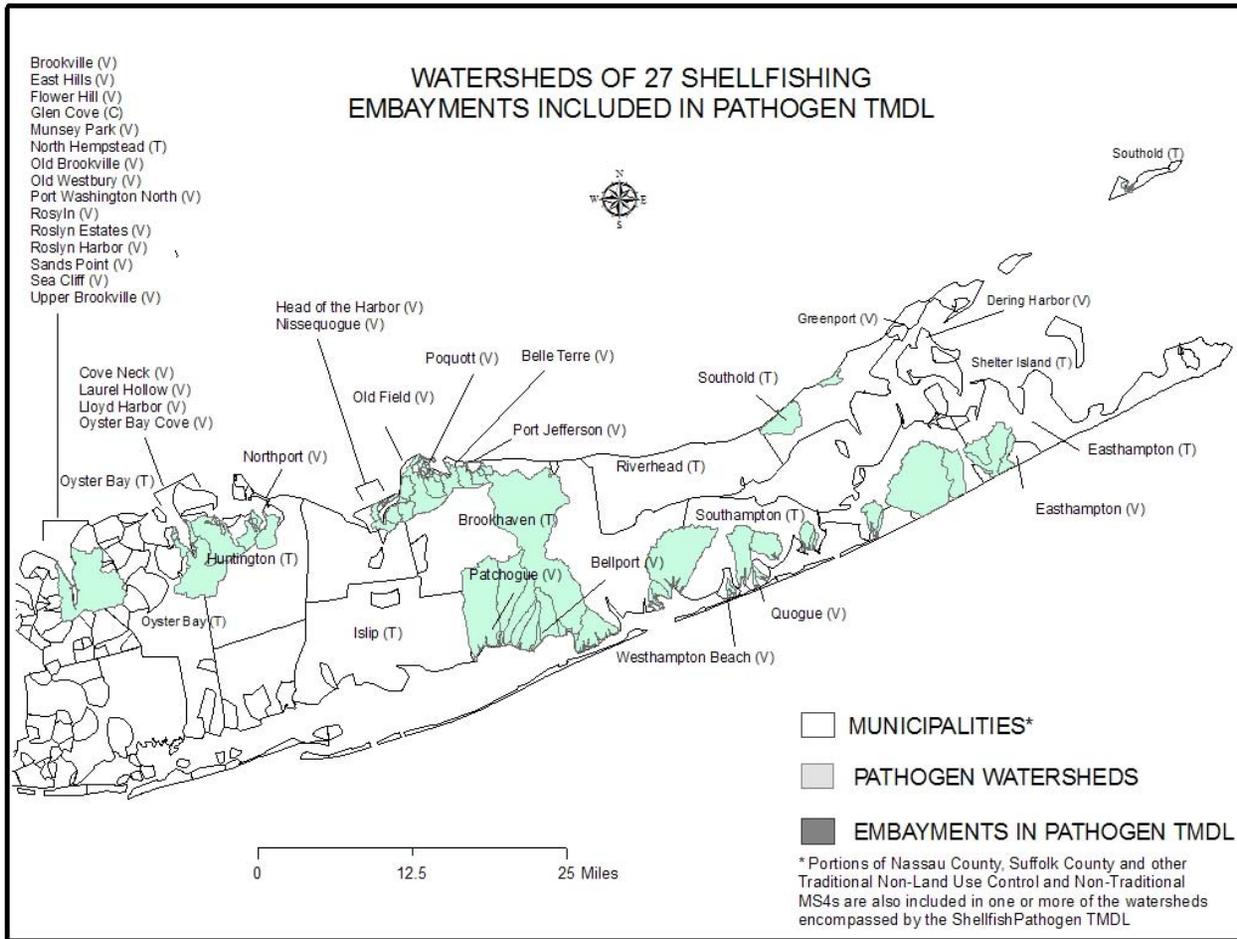


Figure 7. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.

APPENDIX 10. LAKE OSCAWANA WATERSHED MAP

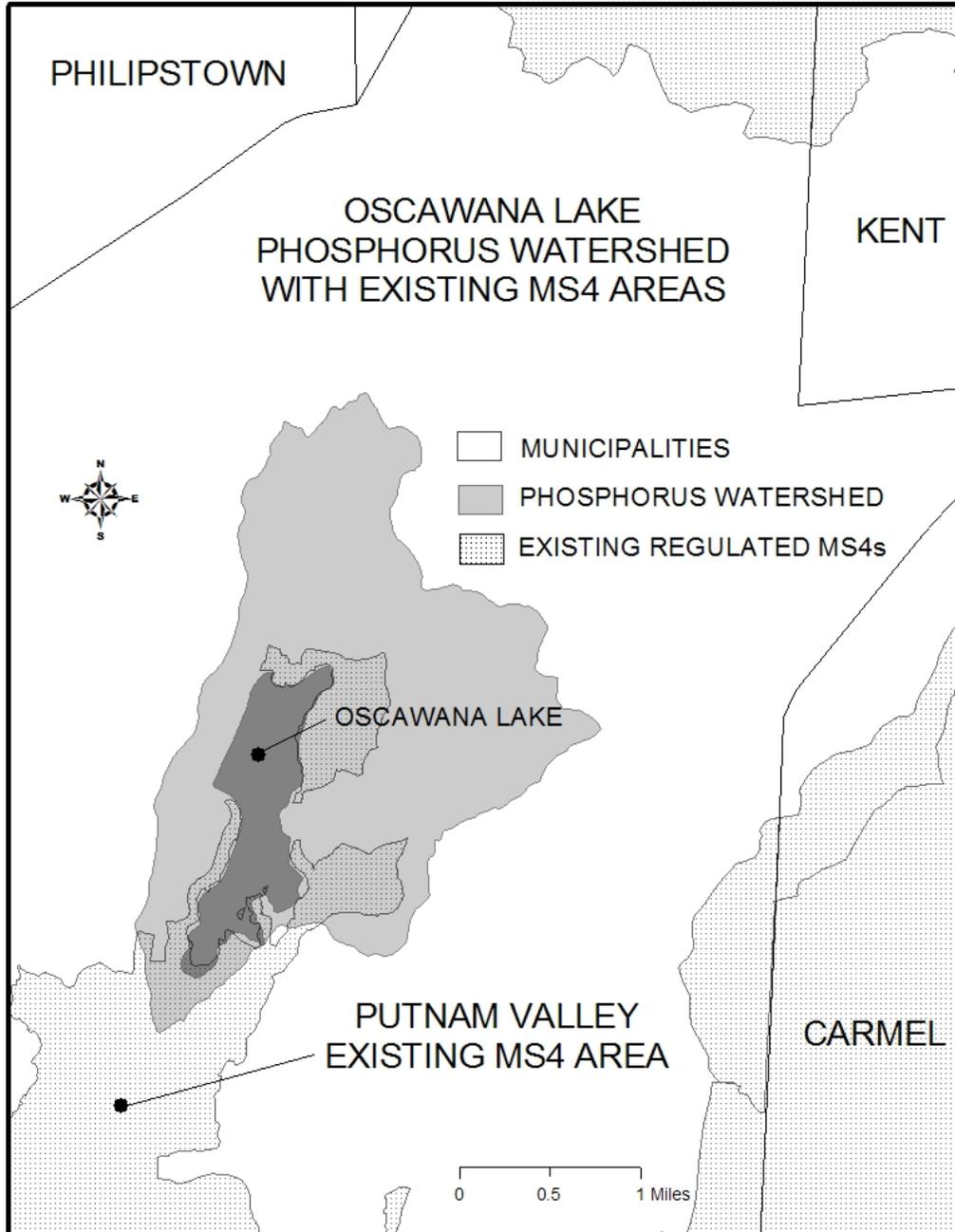


Figure 8. The requirements of watershed improvement strategies apply to the sewersheds within the shaded areas.



Department of
Environmental
Conservation

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SPDES GENERAL PERMIT
FOR STORMWATER DISCHARGES

From

CONSTRUCTION ACTIVITY

Permit No. GP- 0-20-001

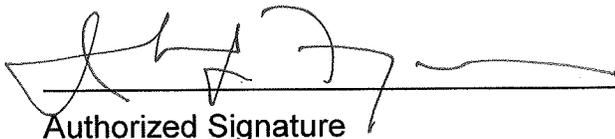
Issued Pursuant to Article 17, Titles 7, 8 and Article 70
of the Environmental Conservation Law

Effective Date: January 29, 2020

Expiration Date: January 28, 2025

John J. Ferguson

Chief Permit Administrator



Authorized Signature

1-23-20

Date

Address: NYS DEC
Division of Environmental Permits
625 Broadway, 4th Floor
Albany, N.Y. 12233-1750

PREFACE

Pursuant to Section 402 of the Clean Water Act (“CWA”), stormwater *discharges* from certain *construction activities* are unlawful unless they are authorized by a *National Pollutant Discharge Elimination System (“NPDES”)* permit or by a state permit program. New York administers the approved State Pollutant Discharge Elimination System (SPDES) program with permits issued in accordance with the New York State Environmental Conservation Law (ECL) Article 17, Titles 7, 8 and Article 70.

An *owner or operator* of a *construction activity* that is eligible for coverage under this permit must obtain coverage prior to the *commencement of construction activity*. Activities that fit the definition of “*construction activity*”, as defined under 40 CFR 122.26(b)(14)(x), (15)(i), and (15)(ii), constitute construction of a *point source* and therefore, pursuant to ECL section 17-0505 and 17-0701, the *owner or operator* must have coverage under a SPDES permit prior to *commencing construction activity*. The *owner or operator* cannot wait until there is an actual *discharge* from the *construction site* to obtain permit coverage.

***Note: The italicized words/phrases within this permit are defined in Appendix A.**

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM
CONSTRUCTION ACTIVITIES**

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Part 1. PERMIT COVERAGE AND LIMITATIONS

A. Permit Application

This permit authorizes stormwater *discharges to surface waters of the State* from the following *construction activities* identified within 40 CFR Parts 122.26(b)(14)(x), 122.26(b)(15)(i) and 122.26(b)(15)(ii), provided all of the eligibility provisions of this permit are met:

1. *Construction activities* involving soil disturbances of one (1) or more acres; including disturbances of less than one acre that are part of a *larger common plan of development or sale* that will ultimately disturb one or more acres of land; excluding *routine maintenance activity* that is performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility;
2. *Construction activities* involving soil disturbances of less than one (1) acre where the Department has determined that a *SPDES* permit is required for stormwater *discharges* based on the potential for contribution to a violation of a *water quality standard* or for significant contribution of *pollutants to surface waters of the State*.
3. *Construction activities* located in the watershed(s) identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.

B. Effluent Limitations Applicable to Discharges from Construction Activities

Discharges authorized by this permit must achieve, at a minimum, the effluent limitations in Part I.B.1. (a) – (f) of this permit. These limitations represent the degree of effluent reduction attainable by the application of best practicable technology currently available.

1. Erosion and Sediment Control Requirements - The *owner or operator* must select, design, install, implement and maintain control measures to *minimize the discharge of pollutants* and prevent a violation of the *water quality standards*. The selection, design, installation, implementation, and maintenance of these control measures must meet the non-numeric effluent limitations in Part I.B.1.(a) – (f) of this permit and be in accordance with the New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016, using sound engineering judgment. Where control measures are not designed in conformance with the design criteria included in the technical standard, the *owner or operator* must include in the *Stormwater Pollution Prevention Plan* (“SWPPP”) the reason(s) for the

deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

- a. **Erosion and Sediment Controls.** Design, install and maintain effective erosion and sediment controls to *minimize* the *discharge of pollutants* and prevent a violation of the *water quality standards*. At a minimum, such controls must be designed, installed and maintained to:
- (i) *Minimize* soil erosion through application of runoff control and soil stabilization control measure to *minimize pollutant discharges*;
 - (ii) Control stormwater *discharges*, including both peak flowrates and total stormwater volume, to *minimize* channel and *streambank* erosion and scour in the immediate vicinity of the *discharge* points;
 - (iii) *Minimize* the amount of soil exposed during *construction activity*;
 - (iv) *Minimize* the disturbance of *steep slopes*;
 - (v) *Minimize* sediment *discharges* from the site;
 - (vi) Provide and maintain *natural buffers* around surface waters, direct stormwater to vegetated areas and maximize stormwater infiltration to reduce *pollutant discharges*, unless *infeasible*;
 - (vii) *Minimize* soil compaction. Minimizing soil compaction is not required where the intended function of a specific area of the site dictates that it be compacted;
 - (viii) Unless *infeasible*, preserve a sufficient amount of topsoil to complete soil restoration and establish a uniform, dense vegetative cover; and
 - (ix) *Minimize* dust. On areas of exposed soil, *minimize* dust through the appropriate application of water or other dust suppression techniques to control the generation of pollutants that could be discharged from the site.
- b. **Soil Stabilization.** In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within fourteen (14) days from the date the current soil disturbance activity ceased. For construction sites that *directly discharge* to one of the 303(d) segments

listed in Appendix E or is located in one of the watersheds listed in Appendix C, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. See Appendix A for definition of *Temporarily Ceased*.

- c. **Dewatering.** *Discharges* from *dewatering* activities, including *discharges* from *dewatering* of trenches and excavations, must be managed by appropriate control measures.

- d. **Pollution Prevention Measures.** Design, install, implement, and maintain effective pollution prevention measures to *minimize* the *discharge* of *pollutants* and prevent a violation of the *water quality standards*. At a minimum, such measures must be designed, installed, implemented and maintained to:
 - (i) *Minimize* the *discharge* of *pollutants* from equipment and vehicle washing, wheel wash water, and other wash waters. This applies to washing operations that use clean water only. Soaps, detergents and solvents cannot be used;

 - (ii) *Minimize* the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, hazardous and toxic waste, and other materials present on the site to precipitation and to stormwater. Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in a *discharge* of *pollutants*, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use) ; and

 - (iii) Prevent the *discharge* of *pollutants* from spills and leaks and implement chemical spill and leak prevention and response procedures.

- e. **Prohibited Discharges.** The following *discharges* are prohibited:
 - (i) Wastewater from washout of concrete;

 - (ii) Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;

- (iii) Fuels, oils, or other *pollutants* used in vehicle and equipment operation and maintenance;
 - (iv) Soaps or solvents used in vehicle and equipment washing; and
 - (v) Toxic or hazardous substances from a spill or other release.
- f. Surface Outlets. When discharging from basins and impoundments, the outlets shall be designed, constructed and maintained in such a manner that sediment does not leave the basin or impoundment and that erosion at or below the outlet does not occur.

C. Post-construction Stormwater Management Practice Requirements

1. The *owner or operator* of a *construction activity* that requires post-construction stormwater management practices pursuant to Part III.C. of this permit must select, design, install, and maintain the practices to meet the *performance criteria* in the New York State Stormwater Management Design Manual (“Design Manual”), dated January 2015, using sound engineering judgment. Where post-construction stormwater management practices (“SMPs”) are not designed in conformance with the *performance criteria* in the Design Manual, the *owner or operator* must include in the SWPPP the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.
2. The *owner or operator* of a *construction activity* that requires post-construction stormwater management practices pursuant to Part III.C. of this permit must design the practices to meet the applicable *sizing criteria* in Part I.C.2.a., b., c. or d. of this permit.

a. Sizing Criteria for New Development

- (i) Runoff Reduction Volume (“RRv”): Reduce the total Water Quality Volume (“WQv”) by application of RR techniques and standard SMPs with RRv capacity. The total WQv shall be calculated in accordance with the criteria in Section 4.2 of the Design Manual.
- (ii) Minimum RRv and Treatment of Remaining Total WQv: Construction activities that cannot meet the criteria in Part I.C.2.a.(i) of this permit due to site limitations shall direct runoff from all newly constructed impervious areas to a RR technique or standard SMP with RRv capacity unless infeasible. The specific site limitations that prevent the reduction of 100% of the WQv shall be documented in the SWPPP.

For each impervious area that is not directed to a RR technique or standard SMP with RRv capacity, the SWPPP must include documentation which demonstrates that all options were considered and for each option explains why it is considered infeasible.

In no case shall the runoff reduction achieved from the newly constructed impervious areas be less than the Minimum RRv as calculated using the criteria in Section 4.3 of the Design Manual.

The remaining portion of the total WQv that cannot be reduced shall be treated by application of standard SMPs.

- (iii) Channel Protection Volume (“Cpv”): Provide 24 hour extended detention of the post-developed 1-year, 24-hour storm event; remaining after runoff reduction. The Cpv requirement does not apply when:
 - (1) Reduction of the entire Cpv is achieved by application of runoff reduction techniques or infiltration systems, or
 - (2) The site discharges directly to tidal waters, or fifth order or larger streams.

- (iv) *Overbank* Flood Control Criteria (“Qp”): Requires storage to attenuate the post-development 10-year, 24-hour peak discharge rate (Qp) to predevelopment rates. The Qp requirement does not apply when:
 - (1) the site discharges directly to tidal waters or fifth order or larger streams, or
 - (2) A downstream analysis reveals that *overbank* control is not required.

- (v) Extreme Flood Control Criteria (“Qf”): Requires storage to attenuate the post-development 100-year, 24-hour peak discharge rate (Qf) to predevelopment rates. The Qf requirement does not apply when:
 - (1) the site discharges directly to tidal waters or fifth order or larger streams, or
 - (2) A downstream analysis reveals that *overbank* control is not required.

b. Sizing Criteria for New Development in Enhanced Phosphorus Removal Watershed

- (i) Runoff Reduction Volume (RRv): Reduce the total Water Quality Volume (WQv) by application of RR techniques and standard SMPs with RRv capacity. The total WQv is the runoff volume from the 1-year, 24 hour design storm over the post-developed watershed and shall be

calculated in accordance with the criteria in Section 10.3 of the Design Manual.

- (ii) Minimum RRv and Treatment of Remaining Total WQv: *Construction activities* that cannot meet the criteria in Part I.C.2.b.(i) of this permit due to *site limitations* shall direct runoff from all newly constructed *impervious areas* to a RR technique or standard SMP with RRv capacity unless *infeasible*. The specific *site limitations* that prevent the reduction of 100% of the WQv shall be documented in the SWPPP. For each *impervious area* that is not directed to a RR technique or standard SMP with RRv capacity, the SWPPP must include documentation which demonstrates that all options were considered and for each option explains why it is considered *infeasible*.

In no case shall the runoff reduction achieved from the newly constructed *impervious areas* be less than the Minimum RRv as calculated using the criteria in Section 10.3 of the Design Manual. The remaining portion of the total WQv that cannot be reduced shall be treated by application of standard SMPs.

- (iii) Channel Protection Volume (Cpv): Provide 24 hour extended detention of the post-developed 1-year, 24-hour storm event; remaining after runoff reduction. The Cpv requirement does not apply when:
 - (1) Reduction of the entire Cpv is achieved by application of runoff reduction techniques or infiltration systems, or
 - (2) The site *discharges* directly to tidal waters, or fifth order or larger streams.
- (iv) *Overbank* Flood Control Criteria (Qp): Requires storage to attenuate the post-development 10-year, 24-hour peak *discharge* rate (Qp) to predevelopment rates. The Qp requirement does not apply when:
 - (1) the site *discharges* directly to tidal waters or fifth order or larger streams, or
 - (2) A downstream analysis reveals that *overbank* control is not required.
- (v) Extreme Flood Control Criteria (Qf): Requires storage to attenuate the post-development 100-year, 24-hour peak *discharge* rate (Qf) to predevelopment rates. The Qf requirement does not apply when:
 - (1) the site *discharges* directly to tidal waters or fifth order or larger streams, or
 - (2) A downstream analysis reveals that *overbank* control is not required.

c. Sizing Criteria for Redevelopment Activity

- (i) Water Quality Volume (WQv): The WQv treatment objective for *redevelopment activity* shall be addressed by one of the following options. *Redevelopment activities* located in an Enhanced Phosphorus Removal Watershed (see Part III.B.3. and Appendix C of this permit) shall calculate the WQv in accordance with Section 10.3 of the Design Manual. All other *redevelopment activities* shall calculate the WQv in accordance with Section 4.2 of the Design Manual.
- (1) Reduce the existing *impervious cover* by a minimum of 25% of the total disturbed, *impervious area*. The Soil Restoration criteria in Section 5.1.6 of the Design Manual must be applied to all newly created pervious areas, or
 - (2) Capture and treat a minimum of 25% of the WQv from the disturbed, *impervious area* by the application of standard SMPs; or reduce 25% of the WQv from the disturbed, *impervious area* by the application of RR techniques or standard SMPs with RRv capacity., or
 - (3) Capture and treat a minimum of 75% of the WQv from the disturbed, *impervious area* as well as any additional runoff from tributary areas by application of the alternative practices discussed in Sections 9.3 and 9.4 of the Design Manual., or
 - (4) Application of a combination of 1, 2 and 3 above that provide a weighted average of at least two of the above methods. Application of this method shall be in accordance with the criteria in Section 9.2.1(B) (IV) of the Design Manual.

If there is an existing post-construction stormwater management practice located on the site that captures and treats runoff from the *impervious area* that is being disturbed, the WQv treatment option selected must, at a minimum, provide treatment equal to the treatment that was being provided by the existing practice(s) if that treatment is greater than the treatment required by options 1 – 4 above.

- (ii) Channel Protection Volume (Cpv): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site.
- (iii) *Overbank* Flood Control Criteria (Qp): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site.
- (iv) Extreme Flood Control Criteria (Qf): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site

d. Sizing Criteria for Combination of Redevelopment Activity and New Development

Construction projects that include both New Development and Redevelopment Activity shall provide post-construction stormwater management controls that meet the sizing criteria calculated as an aggregate of the Sizing Criteria in Part I.C.2.a. or b. of this permit for the New Development portion of the project and Part I.C.2.c of this permit for Redevelopment Activity portion of the project.

D. Maintaining Water Quality

The Department expects that compliance with the conditions of this permit will control *discharges* necessary to meet applicable *water quality standards*. It shall be a violation of the *ECL* for any discharge to either cause or contribute to a violation of *water quality standards* as contained in Parts 700 through 705 of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York, such as:

1. There shall be no increase in turbidity that will cause a substantial visible contrast to natural conditions;
2. There shall be no increase in suspended, colloidal or settleable solids that will cause deposition or impair the waters for their best usages; and
3. There shall be no residue from oil and floating substances, nor visible oil film, nor globules of grease.

If there is evidence indicating that the stormwater *discharges* authorized by this permit are causing, have the reasonable potential to cause, or are contributing to a violation of the *water quality standards*; the *owner or operator* must take appropriate corrective action in accordance with Part IV.C.5. of this general permit and document in accordance with Part IV.C.4. of this general permit. To address the *water quality standard* violation the *owner or operator* may need to provide additional information, include and implement appropriate controls in the SWPPP to correct the problem, or obtain an individual SPDES permit.

If there is evidence indicating that despite compliance with the terms and conditions of this general permit it is demonstrated that the stormwater *discharges* authorized by this permit are causing or contributing to a violation of *water quality standards*, or if the Department determines that a modification of the permit is necessary to prevent a violation of *water quality standards*, the authorized *discharges* will no longer be eligible for coverage under this permit. The Department may require the *owner or operator* to obtain an individual SPDES permit to continue discharging.

E. Eligibility Under This General Permit

1. This permit may authorize all *discharges* of stormwater from *construction activity* to *surface waters of the State* and *groundwaters* except for ineligible *discharges* identified under subparagraph F. of this Part.
2. Except for non-stormwater *discharges* explicitly listed in the next paragraph, this permit only authorizes stormwater *discharges*; including stormwater runoff, snowmelt runoff, and surface runoff and drainage, from *construction activities*.
3. Notwithstanding paragraphs E.1 and E.2 above, the following non-stormwater discharges are authorized by this permit: those listed in 6 NYCRR 750-1.2(a)(29)(vi), with the following exception: “Discharges from firefighting activities are authorized only when the firefighting activities are emergencies/unplanned”; waters to which other components have not been added that are used to control dust in accordance with the SWPPP; and uncontaminated *discharges* from *construction site* de-watering operations. All non-stormwater discharges must be identified in the SWPPP. Under all circumstances, the *owner or operator* must still comply with *water quality standards* in Part I.D of this permit.
4. The *owner or operator* must maintain permit eligibility to *discharge* under this permit. Any *discharges* that are not compliant with the eligibility conditions of this permit are not authorized by the permit and the *owner or operator* must either apply for a separate permit to cover those ineligible *discharges* or take steps necessary to make the *discharge* eligible for coverage.

F. Activities Which Are Ineligible for Coverage Under This General Permit

All of the following are **not** authorized by this permit:

1. *Discharges* after *construction activities* have been completed and the site has undergone *final stabilization*;
2. *Discharges* that are mixed with sources of non-stormwater other than those expressly authorized under subsection E.3. of this Part and identified in the SWPPP required by this permit;
3. *Discharges* that are required to obtain an individual SPDES permit or another SPDES general permit pursuant to Part VII.K. of this permit;
4. *Construction activities* or *discharges* from *construction activities* that may adversely affect an *endangered or threatened species* unless the *owner or*

operator has obtained a permit issued pursuant to 6 NYCRR Part 182 for the project or the Department has issued a letter of non-jurisdiction for the project. All documentation necessary to demonstrate eligibility shall be maintained on site in accordance with Part II.D.2 of this permit;

5. *Discharges* which either cause or contribute to a violation of *water quality standards* adopted pursuant to the *ECL* and its accompanying regulations;
6. *Construction activities* for residential, commercial and institutional projects:
 - a. Where the *discharges* from the *construction activities* are tributary to waters of the state classified as AA or AA-s; and
 - b. Which are undertaken on land with no existing *impervious cover*; and
 - c. Which disturb one (1) or more acres of land designated on the current United States Department of Agriculture (“USDA”) Soil Survey as Soil Slope Phase “D”, (provided the map unit name is inclusive of slopes greater than 25%), or Soil Slope Phase “E” or “F” (regardless of the map unit name), or a combination of the three designations.
7. *Construction activities* for linear transportation projects and linear utility projects:
 - a. Where the *discharges* from the *construction activities* are tributary to waters of the state classified as AA or AA-s; and
 - b. Which are undertaken on land with no existing *impervious cover*; and
 - c. Which disturb two (2) or more acres of land designated on the current USDA Soil Survey as Soil Slope Phase “D” (provided the map unit name is inclusive of slopes greater than 25%), or Soil Slope Phase “E” or “F” (regardless of the map unit name), or a combination of the three designations.

8. *Construction activities* that have the potential to affect an *historic property*, unless there is documentation that such impacts have been resolved. The following documentation necessary to demonstrate eligibility with this requirement shall be maintained on site in accordance with Part II.D.2 of this permit and made available to the Department in accordance with Part VII.F of this permit:
- a. Documentation that the *construction activity* is not within an archeologically sensitive area indicated on the sensitivity map, and that the *construction activity* is not located on or immediately adjacent to a property listed or determined to be eligible for listing on the National or State Registers of Historic Places, and that there is no new permanent building on the *construction site* within the following distances from a building, structure, or object that is more than 50 years old, or if there is such a new permanent building on the *construction site* within those parameters that NYS Office of Parks, Recreation and Historic Preservation (OPRHP), a Historic Preservation Commission of a Certified Local Government, or a qualified preservation professional has determined that the building, structure, or object more than 50 years old is not historically/archeologically significant.
 - 1-5 acres of disturbance - 20 feet
 - 5-20 acres of disturbance - 50 feet
 - 20+ acres of disturbance - 100 feet, or
 - b. DEC consultation form sent to OPRHP, and copied to the NYS DEC Agency Historic Preservation Officer (APO), and
 - (i) the State Environmental Quality Review (SEQR) Environmental Assessment Form (EAF) with a negative declaration or the Findings Statement, with documentation of OPRHP's agreement with the resolution; or
 - (ii) documentation from OPRHP that the *construction activity* will result in No Impact; or
 - (iii) documentation from OPRHP providing a determination of No Adverse Impact; or
 - (iv) a Letter of Resolution signed by the owner/operator, OPRHP and the DEC APO which allows for this *construction activity* to be eligible for coverage under the general permit in terms of the State Historic Preservation Act (SHPA); or
 - c. Documentation of satisfactory compliance with Section 106 of the National Historic Preservation Act for a coterminous project area:

- (i) No Affect
- (ii) No Adverse Affect
- (iii) Executed Memorandum of Agreement, or

d. Documentation that:

- (i) SHPA Section 14.09 has been completed by NYS DEC or another state agency.
9. *Discharges from construction activities* that are subject to an existing SPDES individual or general permit where a SPDES permit for *construction activity* has been terminated or denied; or where the *owner or operator* has failed to renew an expired individual permit.

Part II. PERMIT COVERAGE

A. How to Obtain Coverage

1. An *owner or operator* of a *construction activity* that is not subject to the requirements of a regulated, traditional land use control MS4 must first prepare a SWPPP in accordance with all applicable requirements of this permit and then submit a completed Notice of Intent (NOI) to the Department to be authorized to discharge under this permit.
2. An *owner or operator* of a *construction activity* that is subject to the requirements of a *regulated, traditional land use control MS4* must first prepare a SWPPP in accordance with all applicable requirements of this permit and then have the SWPPP reviewed and accepted by the *regulated, traditional land use control MS4* prior to submitting the NOI to the Department. The *owner or operator* shall have the “MS4 SWPPP Acceptance” form signed in accordance with Part VII.H., and then submit that form along with a completed NOI to the Department.
3. The requirement for an *owner or operator* to have its SWPPP reviewed and accepted by the *regulated, traditional land use control MS4* prior to submitting the NOI to the Department does not apply to an *owner or operator* that is obtaining permit coverage in accordance with the requirements in Part II.F. (Change of *Owner or Operator*) or where the *owner or operator* of the *construction activity* is the *regulated, traditional land use control MS4* . This exemption does not apply to *construction activities* subject to the New York City Administrative Code.

B. Notice of Intent (NOI) Submittal

1. Prior to December 21, 2020, an owner or operator shall use either the electronic (eNOI) or paper version of the NOI that the Department prepared. Both versions of the NOI are located on the Department's website (<http://www.dec.ny.gov/>). The paper version of the NOI shall be signed in accordance with Part VII.H. of this permit and submitted to the following address:

**NOTICE OF INTENT
NYS DEC, Bureau of Water Permits
625 Broadway, 4th Floor
Albany, New York 12233-3505**

2. Beginning December 21, 2020 and in accordance with EPA's 2015 NPDES Electronic Reporting Rule (40 CFR Part 127), the *owner or operator* must submit the NOI electronically using the *Department's* online NOI.
3. The *owner or operator* shall have the SWPPP preparer sign the "SWPPP Preparer Certification" statement on the NOI prior to submitting the form to the Department.
4. As of the date the NOI is submitted to the Department, the *owner or operator* shall make the NOI and SWPPP available for review and copying in accordance with the requirements in Part VII.F. of this permit.

C. Permit Authorization

1. An *owner or operator* shall not *commence construction activity* until their authorization to *discharge* under this permit goes into effect.
2. Authorization to *discharge* under this permit will be effective when the *owner or operator* has satisfied all of the following criteria:
 - a. project review pursuant to the State Environmental Quality Review Act ("SEQRA") have been satisfied, when SEQRA is applicable. See the Department's website (<http://www.dec.ny.gov/>) for more information,
 - b. where required, all necessary Department permits subject to the *Uniform Procedures Act ("UPA")* (see 6 NYCRR Part 621), or the equivalent from another New York State agency, have been obtained, unless otherwise notified by the Department pursuant to 6 NYCRR 621.3(a)(4). *Owners or operators of construction activities* that are required to obtain *UPA* permits

must submit a preliminary SWPPP to the appropriate DEC Permit Administrator at the Regional Office listed in Appendix F at the time all other necessary *UPA* permit applications are submitted. The preliminary SWPPP must include sufficient information to demonstrate that the *construction activity* qualifies for authorization under this permit,

- c. the final SWPPP has been prepared, and
 - d. a complete NOI has been submitted to the Department in accordance with the requirements of this permit.
3. An *owner or operator* that has satisfied the requirements of Part II.C.2 above will be authorized to *discharge* stormwater from their *construction activity* in accordance with the following schedule:
- a. For *construction activities* that are not subject to the requirements of a *regulated, traditional land use control MS4*:
 - (i) Five (5) business days from the date the Department receives a complete electronic version of the NOI (eNOI) for *construction activities* with a SWPPP that has been prepared in conformance with the design criteria in the technical standard referenced in Part III.B.1 and the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C.; or
 - (ii) Sixty (60) business days from the date the Department receives a complete NOI (electronic or paper version) for *construction activities* with a SWPPP that has not been prepared in conformance with the design criteria in technical standard referenced in Part III.B.1. or, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C., the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, or;
 - (iii) Ten (10) business days from the date the Department receives a complete paper version of the NOI for *construction activities* with a SWPPP that has been prepared in conformance with the design criteria in the technical standard referenced in Part III.B.1 and the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C.

- b. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4*:
 - (i) Five (5) business days from the date the Department receives both a complete electronic version of the NOI (eNOI) and signed “MS4 SWPPP Acceptance” form, or
 - (ii) Ten (10) business days from the date the Department receives both a complete paper version of the NOI and signed “MS4 SWPPP Acceptance” form.
4. Coverage under this permit authorizes stormwater *discharges* from only those areas of disturbance that are identified in the NOI. If an *owner or operator* wishes to have stormwater *discharges* from future or additional areas of disturbance authorized, they must submit a new NOI that addresses that phase of the development, unless otherwise notified by the Department. The *owner or operator* shall not *commence construction activity* on the future or additional areas until their authorization to *discharge* under this permit goes into effect in accordance with Part II.C. of this permit.

D. General Requirements For Owners or Operators With Permit Coverage

1. The *owner or operator* shall ensure that the provisions of the SWPPP are implemented from the *commencement of construction activity* until all areas of disturbance have achieved *final stabilization* and the Notice of Termination (“NOT”) has been submitted to the Department in accordance with Part V. of this permit. This includes any changes made to the SWPPP pursuant to Part III.A.4. of this permit.
2. The *owner or operator* shall maintain a copy of the General Permit (GP-0-20-001), NOI, *NOI Acknowledgment Letter*, SWPPP, MS4 SWPPP Acceptance form, inspection reports, responsible contractor’s or subcontractor’s certification statement (see Part III.A.6.), and all documentation necessary to demonstrate eligibility with this permit at the *construction site* until all disturbed areas have achieved *final stabilization* and the NOT has been submitted to the Department. The documents must be maintained in a secure location, such as a job trailer, on-site construction office, or mailbox with lock. The secure location must be accessible during normal business hours to an individual performing a compliance inspection.
3. The *owner or operator of a construction activity* shall not disturb greater than five (5) acres of soil at any one time without prior written authorization from the Department or, in areas under the jurisdiction of a *regulated, traditional land*

- use control MS4, the regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*). At a minimum, the *owner or operator* must comply with the following requirements in order to be authorized to disturb greater than five (5) acres of soil at any one time:
- a. The *owner or operator* shall have a *qualified inspector* conduct **at least** two (2) site inspections in accordance with Part IV.C. of this permit every seven (7) calendar days, for as long as greater than five (5) acres of soil remain disturbed. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.
 - b. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. The soil stabilization measures selected shall be in conformance with the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016.
 - c. The *owner or operator* shall prepare a phasing plan that defines maximum disturbed area per phase and shows required cuts and fills.
 - d. The *owner or operator* shall install any additional site-specific practices needed to protect water quality.
 - e. The *owner or operator* shall include the requirements above in their SWPPP.
4. In accordance with statute, regulations, and the terms and conditions of this permit, the Department may suspend or revoke an *owner's or operator's* coverage under this permit at any time if the Department determines that the SWPPP does not meet the permit requirements or consistent with Part VII.K..
 5. Upon a finding of significant non-compliance with the practices described in the SWPPP or violation of this permit, the Department may order an immediate stop to all activity at the site until the non-compliance is remedied. The stop work order shall be in writing, describe the non-compliance in detail, and be sent to the *owner or operator*.
 6. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4*, the *owner or operator* shall notify the

regulated, traditional land use control MS4 in writing of any planned amendments or modifications to the post-construction stormwater management practice component of the SWPPP required by Part III.A. 4. and 5. of this permit. Unless otherwise notified by the *regulated, traditional land use control MS4*, the *owner or operator* shall have the SWPPP amendments or modifications reviewed and accepted by the *regulated, traditional land use control MS4* prior to commencing construction of the post-construction stormwater management practice.

E. Permit Coverage for Discharges Authorized Under GP-0-15-002

1. Upon renewal of SPDES General Permit for Stormwater Discharges from *Construction Activity* (Permit No. GP-0-15-002), an *owner or operator* of a *construction activity* with coverage under GP-0-15-002, as of the effective date of GP- 0-20-001, shall be authorized to *discharge* in accordance with GP- 0-20-001, unless otherwise notified by the Department.

An *owner or operator* may continue to implement the technical/design components of the post-construction stormwater management controls provided that such design was done in conformance with the technical standards in place at the time of initial project authorization. However, they must comply with the other, non-design provisions of GP-0-20-001.

F. Change of Owner or Operator

1. When property ownership changes or when there is a change in operational control over the construction plans and specifications, the original *owner or operator* must notify the new *owner or operator*, in writing, of the requirement to obtain permit coverage by submitting a NOI with the Department. For *construction activities* subject to the requirements of a *regulated, traditional land use control MS4*, the original *owner or operator* must also notify the MS4, in writing, of the change in ownership at least 30 calendar days prior to the change in ownership.
2. Once the new *owner or operator* obtains permit coverage, the original *owner or operator* shall then submit a completed NOT with the name and permit identification number of the new *owner or operator* to the Department at the address in Part II.B.1. of this permit. If the original *owner or operator* maintains ownership of a portion of the *construction activity* and will disturb soil, they must maintain their coverage under the permit.
3. Permit coverage for the new *owner or operator* will be effective as of the date the Department receives a complete NOI, provided the original *owner or*

operator was not subject to a sixty (60) business day authorization period that has not expired as of the date the Department receives the NOI from the new *owner or operator*.

Part III. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. General SWPPP Requirements

1. A SWPPP shall be prepared and implemented by the *owner or operator* of each *construction activity* covered by this permit. The SWPPP must document the selection, design, installation, implementation and maintenance of the control measures and practices that will be used to meet the effluent limitations in Part I.B. of this permit and where applicable, the post-construction stormwater management practice requirements in Part I.C. of this permit. The SWPPP shall be prepared prior to the submittal of the NOI. The NOI shall be submitted to the Department prior to the *commencement of construction activity*. A copy of the completed, final NOI shall be included in the SWPPP.
2. The SWPPP shall describe the erosion and sediment control practices and where required, post-construction stormwater management practices that will be used and/or constructed to reduce the *pollutants* in stormwater *discharges* and to assure compliance with the terms and conditions of this permit. In addition, the SWPPP shall identify potential sources of pollution which may reasonably be expected to affect the quality of stormwater *discharges*.
3. All SWPPPs that require the post-construction stormwater management practice component shall be prepared by a *qualified professional* that is knowledgeable in the principles and practices of stormwater management and treatment.
4. The *owner or operator* must keep the SWPPP current so that it at all times accurately documents the erosion and sediment controls practices that are being used or will be used during construction, and all post-construction stormwater management practices that will be constructed on the site. At a minimum, the *owner or operator* shall amend the SWPPP, including construction drawings:
 - a. whenever the current provisions prove to be ineffective in minimizing *pollutants* in stormwater *discharges* from the site;

- b. whenever there is a change in design, construction, or operation at the *construction site* that has or could have an effect on the *discharge* of *pollutants*;
 - c. to address issues or deficiencies identified during an inspection by the *qualified inspector*, the Department or other regulatory authority; and
 - d. to document the final construction conditions.
5. The Department may notify the *owner or operator* at any time that the SWPPP does not meet one or more of the minimum requirements of this permit. The notification shall be in writing and identify the provisions of the SWPPP that require modification. Within fourteen (14) calendar days of such notification, or as otherwise indicated by the Department, the *owner or operator* shall make the required changes to the SWPPP and submit written notification to the Department that the changes have been made. If the *owner or operator* does not respond to the Department's comments in the specified time frame, the Department may suspend the *owner's or operator's* coverage under this permit or require the *owner or operator* to obtain coverage under an individual SPDES permit in accordance with Part II.D.4. of this permit.
6. Prior to the *commencement of construction activity*, the *owner or operator* must identify the contractor(s) and subcontractor(s) that will be responsible for installing, constructing, repairing, replacing, inspecting and maintaining the erosion and sediment control practices included in the SWPPP; and the contractor(s) and subcontractor(s) that will be responsible for constructing the post-construction stormwater management practices included in the SWPPP. The *owner or operator* shall have each of the contractors and subcontractors identify at least one person from their company that will be responsible for implementation of the SWPPP. This person shall be known as the *trained contractor*. The *owner or operator* shall ensure that at least one *trained contractor* is on site on a daily basis when soil disturbance activities are being performed.

The *owner or operator* shall have each of the contractors and subcontractors identified above sign a copy of the following certification statement below before they commence any *construction activity*:

"I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the *qualified inspector* during a site inspection. I also understand that the *owner or operator* must comply with

the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater *discharges* from *construction activities* and that it is unlawful for any person to cause or contribute to a violation of *water quality standards*. Furthermore, I am aware that there are significant penalties for submitting false information, that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations"

In addition to providing the certification statement above, the certification page must also identify the specific elements of the SWPPP that each contractor and subcontractor will be responsible for and include the name and title of the person providing the signature; the name and title of the *trained contractor* responsible for SWPPP implementation; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification statement is signed. The *owner or operator* shall attach the certification statement(s) to the copy of the SWPPP that is maintained at the *construction site*. If new or additional contractors are hired to implement measures identified in the SWPPP after construction has commenced, they must also sign the certification statement and provide the information listed above.

7. For projects where the Department requests a copy of the SWPPP or inspection reports, the *owner or operator* shall submit the documents in both electronic (PDF only) and paper format within five (5) business days, unless otherwise notified by the Department.

B. Required SWPPP Contents

1. Erosion and sediment control component - All SWPPPs prepared pursuant to this permit shall include erosion and sediment control practices designed in conformance with the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016. Where erosion and sediment control practices are not designed in conformance with the design criteria included in the technical standard, the *owner or operator* must demonstrate *equivalence* to the technical standard. At a minimum, the erosion and sediment control component of the SWPPP shall include the following:
 - a. Background information about the scope of the project, including the location, type and size of project

- b. A site map/construction drawing(s) for the project, including a general location map. At a minimum, the site map shall show the total site area; all improvements; areas of disturbance; areas that will not be disturbed; existing vegetation; on-site and adjacent off-site surface water(s); floodplain/floodway boundaries; wetlands and drainage patterns that could be affected by the *construction activity*; existing and final contours ; locations of different soil types with boundaries; material, waste, borrow or equipment storage areas located on adjacent properties; and location(s) of the stormwater *discharge(s)*;
- c. A description of the soil(s) present at the site, including an identification of the Hydrologic Soil Group (HSG);
- d. A construction phasing plan and sequence of operations describing the intended order of *construction activities*, including clearing and grubbing, excavation and grading, utility and infrastructure installation and any other activity at the site that results in soil disturbance;
- e. A description of the minimum erosion and sediment control practices to be installed or implemented for each *construction activity* that will result in soil disturbance. Include a schedule that identifies the timing of initial placement or implementation of each erosion and sediment control practice and the minimum time frames that each practice should remain in place or be implemented;
- f. A temporary and permanent soil stabilization plan that meets the requirements of this general permit and the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016, for each stage of the project, including initial land clearing and grubbing to project completion and achievement of *final stabilization*;
- g. A site map/construction drawing(s) showing the specific location(s), size(s), and length(s) of each erosion and sediment control practice;
- h. The dimensions, material specifications, installation details, and operation and maintenance requirements for all erosion and sediment control practices. Include the location and sizing of any temporary sediment basins and structural practices that will be used to divert flows from exposed soils;
- i. A maintenance inspection schedule for the contractor(s) identified in Part III.A.6. of this permit, to ensure continuous and effective operation of the erosion and sediment control practices. The maintenance inspection

schedule shall be in accordance with the requirements in the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016;

- j. A description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a *pollutant* source in the stormwater *discharges*;
 - k. A description and location of any stormwater *discharges* associated with industrial activity other than construction at the site, including, but not limited to, stormwater *discharges* from asphalt plants and concrete plants located on the *construction site*; and
 - l. Identification of any elements of the design that are not in conformance with the design criteria in the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016. Include the reason for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.
2. Post-construction stormwater management practice component – The *owner or operator* of any construction project identified in Table 2 of Appendix B as needing post-construction stormwater management practices shall prepare a SWPPP that includes practices designed in conformance with the applicable *sizing criteria* in Part I.C.2.a., c. or d. of this permit and the *performance criteria* in the technical standard, New York State Stormwater Management Design Manual dated January 2015

Where post-construction stormwater management practices are not designed in conformance with the *performance criteria* in the technical standard, the *owner or operator* must include in the SWPPP the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

The post-construction stormwater management practice component of the SWPPP shall include the following:

- a. Identification of all post-construction stormwater management practices to be constructed as part of the project. Include the dimensions, material specifications and installation details for each post-construction stormwater management practice;

- b. A site map/construction drawing(s) showing the specific location and size of each post-construction stormwater management practice;
- c. A Stormwater Modeling and Analysis Report that includes:
 - (i) Map(s) showing pre-development conditions, including watershed/subcatchments boundaries, flow paths/routing, and design points;
 - (ii) Map(s) showing post-development conditions, including watershed/subcatchments boundaries, flow paths/routing, design points and post-construction stormwater management practices;
 - (iii) Results of stormwater modeling (i.e. hydrology and hydraulic analysis) for the required storm events. Include supporting calculations (model runs), methodology, and a summary table that compares pre and post-development runoff rates and volumes for the different storm events;
 - (iv) Summary table, with supporting calculations, which demonstrates that each post-construction stormwater management practice has been designed in conformance with the *sizing criteria* included in the Design Manual;
 - (v) Identification of any *sizing criteria* that is not required based on the requirements included in Part I.C. of this permit; and
 - (vi) Identification of any elements of the design that are not in conformance with the *performance criteria* in the Design Manual. Include the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the Design Manual;
- d. Soil testing results and locations (test pits, borings);
- e. Infiltration test results, when required; and
- f. An operations and maintenance plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post-construction stormwater management practice. The plan shall identify the entity that will be responsible for the long term operation and maintenance of each practice.

3. Enhanced Phosphorus Removal Standards - All construction projects identified in Table 2 of Appendix B that are located in the watersheds identified in Appendix C shall prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the applicable *sizing criteria* in Part I.C.2. b., c. or d. of this permit and the *performance criteria*, Enhanced Phosphorus Removal Standards included in the Design Manual. At a minimum, the post-construction stormwater management practice component of the SWPPP shall include items 2.a - 2.f. above.

C. Required SWPPP Components by Project Type

Unless otherwise notified by the Department, *owners or operators of construction activities* identified in Table 1 of Appendix B are required to prepare a SWPPP that only includes erosion and sediment control practices designed in conformance with Part III.B.1 of this permit. *Owners or operators of the construction activities* identified in Table 2 of Appendix B shall prepare a SWPPP that also includes post-construction stormwater management practices designed in conformance with Part III.B.2 or 3 of this permit.

Part IV. INSPECTION AND MAINTENANCE REQUIREMENTS

A. General Construction Site Inspection and Maintenance Requirements

1. The *owner or operator* must ensure that all erosion and sediment control practices (including pollution prevention measures) and all post-construction stormwater management practices identified in the SWPPP are inspected and maintained in accordance with Part IV.B. and C. of this permit.
2. The terms of this permit shall not be construed to prohibit the State of New York from exercising any authority pursuant to the ECL, common law or federal law, or prohibit New York State from taking any measures, whether civil or criminal, to prevent violations of the laws of the State of New York or protect the public health and safety and/or the environment.

B. Contractor Maintenance Inspection Requirements

1. The *owner or operator* of each *construction activity* identified in Tables 1 and 2 of Appendix B shall have a *trained contractor* inspect the erosion and sediment control practices and pollution prevention measures being implemented within the active work area daily to ensure that they are being maintained in effective operating condition at all times. If deficiencies are identified, the contractor shall

begin implementing corrective actions within one business day and shall complete the corrective actions in a reasonable time frame.

2. For construction sites where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and *temporary stabilization* measures have been applied to all disturbed areas, the *trained contractor* can stop conducting the maintenance inspections. The *trained contractor* shall begin conducting the maintenance inspections in accordance with Part IV.B.1. of this permit as soon as soil disturbance activities resume.
3. For construction sites where soil disturbance activities have been shut down with partial project completion, the *trained contractor* can stop conducting the maintenance inspections if all areas disturbed as of the project shutdown date have achieved *final stabilization* and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational.

C. Qualified Inspector Inspection Requirements

The *owner or operator* shall have a *qualified inspector* conduct site inspections in conformance with the following requirements:

[Note: The *trained contractor* identified in Part III.A.6. and IV.B. of this permit **cannot** conduct the *qualified inspector* site inspections unless they meet the *qualified inspector* qualifications included in Appendix A. In order to perform these inspections, the *trained contractor* would have to be a:

- licensed Professional Engineer,
 - Certified Professional in Erosion and Sediment Control (CPESC),
 - New York State Erosion and Sediment Control Certificate Program holder
 - Registered Landscape Architect, or
 - someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided they have received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity].
1. A *qualified inspector* shall conduct site inspections for all *construction activities* identified in Tables 1 and 2 of Appendix B, with the exception of:
 - a. the construction of a single family residential subdivision with 25% or less *impervious cover* at total site build-out that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres and is not located

in one of the watersheds listed in Appendix C and not directly discharging to one of the 303(d) segments listed in Appendix E;

- b. the construction of a single family home that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres and is not located in one of the watersheds listed in Appendix C and not directly discharging to one of the 303(d) segments listed in Appendix E;
 - c. construction on agricultural property that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres; and
 - d. *construction activities* located in the watersheds identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.
2. Unless otherwise notified by the Department, the *qualified inspector* shall conduct site inspections in accordance with the following timetable:
- a. For construction sites where soil disturbance activities are on-going, the *qualified inspector* shall conduct a site inspection at least once every seven (7) calendar days.
 - b. For construction sites where soil disturbance activities are on-going and the *owner or operator* has received authorization in accordance with Part II.D.3 to disturb greater than five (5) acres of soil at any one time, the *qualified inspector* shall conduct at least two (2) site inspections every seven (7) calendar days. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.
 - c. For construction sites where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and *temporary stabilization* measures have been applied to all disturbed areas, the *qualified inspector* shall conduct a site inspection at least once every thirty (30) calendar days. The *owner or operator* shall notify the DOW Water (SPDES) Program contact at the Regional Office (see contact information in Appendix F) or, in areas under the jurisdiction of a *regulated, traditional land use control MS4*, the *regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*) in writing prior to reducing the frequency of inspections.

- d. For construction sites where soil disturbance activities have been shut down with partial project completion, the *qualified inspector* can stop conducting inspections if all areas disturbed as of the project shutdown date have achieved *final stabilization* and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational. The *owner or operator* shall notify the DOW Water (SPDES) Program contact at the Regional Office (see contact information in Appendix F) or, in areas under the jurisdiction of a *regulated, traditional land use control MS4*, the *regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*) in writing prior to the shutdown. If soil disturbance activities are not resumed within 2 years from the date of shutdown, the *owner or operator* shall have the *qualified inspector* perform a final inspection and certify that all disturbed areas have achieved *final stabilization*, and all temporary, structural erosion and sediment control measures have been removed; and that all post-construction stormwater management practices have been constructed in conformance with the SWPPP by signing the “*Final Stabilization*” and “*Post-Construction Stormwater Management Practice*” certification statements on the NOT. The *owner or operator* shall then submit the completed NOT form to the address in Part II.B.1 of this permit.
 - e. For construction sites that directly *discharge* to one of the 303(d) segments listed in Appendix E or is located in one of the watersheds listed in Appendix C, the *qualified inspector* shall conduct at least two (2) site inspections every seven (7) calendar days. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.
3. At a minimum, the *qualified inspector* shall inspect all erosion and sediment control practices and pollution prevention measures to ensure integrity and effectiveness, all post-construction stormwater management practices under construction to ensure that they are constructed in conformance with the SWPPP, all areas of disturbance that have not achieved *final stabilization*, all points of *discharge* to natural surface waterbodies located within, or immediately adjacent to, the property boundaries of the *construction site*, and all points of *discharge* from the *construction site*.
 4. The *qualified inspector* shall prepare an inspection report subsequent to each and every inspection. At a minimum, the inspection report shall include and/or address the following:

- a. Date and time of inspection;
- b. Name and title of person(s) performing inspection;
- c. A description of the weather and soil conditions (e.g. dry, wet, saturated) at the time of the inspection;
- d. A description of the condition of the runoff at all points of *discharge* from the *construction site*. This shall include identification of any *discharges* of sediment from the *construction site*. Include *discharges* from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow;
- e. A description of the condition of all natural surface waterbodies located within, or immediately adjacent to, the property boundaries of the *construction site* which receive runoff from disturbed areas. This shall include identification of any *discharges* of sediment to the surface waterbody;
- f. Identification of all erosion and sediment control practices and pollution prevention measures that need repair or maintenance;
- g. Identification of all erosion and sediment control practices and pollution prevention measures that were not installed properly or are not functioning as designed and need to be reinstalled or replaced;
- h. Description and sketch of areas with active soil disturbance activity, areas that have been disturbed but are inactive at the time of the inspection, and areas that have been stabilized (temporary and/or final) since the last inspection;
- i. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards;
- j. Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices and pollution prevention measures; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s);
- k. Identification and status of all corrective actions that were required by previous inspection; and

- I. Digital photographs, with date stamp, that clearly show the condition of all practices that have been identified as needing corrective actions. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report being maintained onsite within seven (7) calendar days of the date of the inspection. The *qualified inspector* shall also take digital photographs, with date stamp, that clearly show the condition of the practice(s) after the corrective action has been completed. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report that documents the completion of the corrective action work within seven (7) calendar days of that inspection.
5. Within one business day of the completion of an inspection, the *qualified inspector* shall notify the *owner or operator* and appropriate contractor or subcontractor identified in Part III.A.6. of this permit of any corrective actions that need to be taken. The contractor or subcontractor shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame.
6. All inspection reports shall be signed by the *qualified inspector*. Pursuant to Part II.D.2. of this permit, the inspection reports shall be maintained on site with the SWPPP.

Part V. TERMINATION OF PERMIT COVERAGE

A. Termination of Permit Coverage

1. An *owner or operator* that is eligible to terminate coverage under this permit must submit a completed NOT form to the address in Part II.B.1 of this permit. The NOT form shall be one which is associated with this permit, signed in accordance with Part VII.H of this permit.
2. An *owner or operator* may terminate coverage when one or more the following conditions have been met:
 - a. Total project completion - All *construction activity* identified in the SWPPP has been completed; and all areas of disturbance have achieved *final stabilization*; and all temporary, structural erosion and sediment control measures have been removed; and all post-construction stormwater management practices have been constructed in conformance with the SWPPP and are operational;

- b. Planned shutdown with partial project completion - All soil disturbance activities have ceased; and all areas disturbed as of the project shutdown date have achieved *final stabilization*; and all temporary, structural erosion and sediment control measures have been removed; and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational;
 - c. A new *owner or operator* has obtained coverage under this permit in accordance with Part II.F. of this permit.
 - d. The *owner or operator* obtains coverage under an alternative SPDES general permit or an individual SPDES permit.
3. For *construction activities* meeting subdivision 2a. or 2b. of this Part, the *owner or operator* shall have the *qualified inspector* perform a final site inspection prior to submitting the NOT. The *qualified inspector* shall, by signing the “*Final Stabilization*” and “Post-Construction Stormwater Management Practice certification statements on the NOT, certify that all the requirements in Part V.A.2.a. or b. of this permit have been achieved.
4. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4* and meet subdivision 2a. or 2b. of this Part, the *owner or operator* shall have the *regulated, traditional land use control MS4* sign the “MS4 Acceptance” statement on the NOT in accordance with the requirements in Part VII.H. of this permit. The *regulated, traditional land use control MS4* official, by signing this statement, has determined that it is acceptable for the *owner or operator* to submit the NOT in accordance with the requirements of this Part. The *regulated, traditional land use control MS4* can make this determination by performing a final site inspection themselves or by accepting the *qualified inspector’s* final site inspection certification(s) required in Part V.A.3. of this permit.
5. For *construction activities* that require post-construction stormwater management practices and meet subdivision 2a. of this Part, the *owner or operator* must, prior to submitting the NOT, ensure one of the following:
 - a. the post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain such practice(s) have been deeded to the municipality in which the practice(s) is located,

- b. an executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s),
- c. for post-construction stormwater management practices that are privately owned, the *owner or operator* has a mechanism in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the *owner or operator's* deed of record,
- d. for post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university, hospital), government agency or authority, or public utility; the *owner or operator* has policy and procedures in place that ensures operation and maintenance of the practices in accordance with the operation and maintenance plan.

Part VI. REPORTING AND RETENTION RECORDS

A. Record Retention

The *owner or operator* shall retain a copy of the NOI, NOI Acknowledgment Letter, SWPPP, MS4 SWPPP Acceptance form and any inspection reports that were prepared in conjunction with this permit for a period of at least five (5) years from the date that the Department receives a complete NOT submitted in accordance with Part V. of this general permit.

B. Addresses

With the exception of the NOI, NOT, and MS4 SWPPP Acceptance form (which must be submitted to the address referenced in Part II.B.1 of this permit), all written correspondence requested by the Department, including individual permit applications, shall be sent to the address of the appropriate DOW Water (SPDES) Program contact at the Regional Office listed in Appendix F.

Part VII. STANDARD PERMIT CONDITIONS

A. Duty to Comply

The *owner or operator* must comply with all conditions of this permit. All contractors and subcontractors associated with the project must comply with the terms of the SWPPP. Any non-compliance with this permit constitutes a violation of the Clean Water

Act (CWA) and the ECL and is grounds for an enforcement action against the *owner or operator* and/or the contractor/subcontractor; permit revocation, suspension or modification; or denial of a permit renewal application. Upon a finding of significant non-compliance with this permit or the applicable SWPPP, the Department may order an immediate stop to all *construction activity* at the site until the non-compliance is remedied. The stop work order shall be in writing, shall describe the non-compliance in detail, and shall be sent to the *owner or operator*.

If any human remains or archaeological remains are encountered during excavation, the *owner or operator* must immediately cease, or cause to cease, all *construction activity* in the area of the remains and notify the appropriate Regional Water Engineer (RWE). *Construction activity* shall not resume until written permission to do so has been received from the RWE.

B. Continuation of the Expired General Permit

This permit expires five (5) years from the effective date. If a new general permit is not issued prior to the expiration of this general permit, an *owner or operator* with coverage under this permit may continue to operate and *discharge* in accordance with the terms and conditions of this general permit, if it is extended pursuant to the State Administrative Procedure Act and 6 NYCRR Part 621, until a new general permit is issued.

C. Enforcement

Failure of the *owner or operator*, its contractors, subcontractors, agents and/or assigns to strictly adhere to any of the permit requirements contained herein shall constitute a violation of this permit. There are substantial criminal, civil, and administrative penalties associated with violating the provisions of this permit. Fines of up to \$37,500 per day for each violation and imprisonment for up to fifteen (15) years may be assessed depending upon the nature and degree of the offense.

D. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for an *owner or operator* in an enforcement action that it would have been necessary to halt or reduce the *construction activity* in order to maintain compliance with the conditions of this permit.

E. Duty to Mitigate

The *owner or operator* and its contractors and subcontractors shall take all reasonable steps to *minimize* or prevent any *discharge* in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

F. Duty to Provide Information

The *owner or operator* shall furnish to the Department, within a reasonable specified time period of a written request, all documentation necessary to demonstrate eligibility and any information to determine compliance with this permit or to determine whether cause exists for modifying or revoking this permit, or suspending or denying coverage under this permit, in accordance with the terms and conditions of this permit. The NOI, SWPPP and inspection reports required by this permit are public documents that the *owner or operator* must make available for review and copying by any person within five (5) business days of the *owner or operator* receiving a written request by any such person to review these documents. Copying of documents will be done at the requester's expense.

G. Other Information

When the *owner or operator* becomes aware that they failed to submit any relevant facts, or submitted incorrect information in the NOI or in any of the documents required by this permit, or have made substantive revisions to the SWPPP (e.g. the scope of the project changes significantly, the type of post-construction stormwater management practice(s) changes, there is a reduction in the sizing of the post-construction stormwater management practice, or there is an increase in the disturbance area or *impervious area*), which were not reflected in the original NOI submitted to the Department, they shall promptly submit such facts or information to the Department using the contact information in Part II.A. of this permit. Failure of the *owner or operator* to correct or supplement any relevant facts within five (5) business days of becoming aware of the deficiency shall constitute a violation of this permit.

H. Signatory Requirements

1. All NOIs and NOTs shall be signed as follows:
 - a. For a corporation these forms shall be signed by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

- (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or
 - (ii) the manager of one or more manufacturing, production or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
 - b. For a partnership or sole proprietorship these forms shall be signed by a general partner or the proprietor, respectively; or
 - c. For a municipality, State, Federal, or other public agency these forms shall be signed by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:
 - (i) the chief executive officer of the agency, or
 - (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).
2. The SWPPP and other information requested by the Department shall be signed by a person described in Part VII.H.1. of this permit or by a duly authorized representative of that person. A person is a duly authorized representative only if:
- a. The authorization is made in writing by a person described in Part VII.H.1. of this permit;
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field,

superintendent, position of *equivalent* responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position) and,

- c. The written authorization shall include the name, title and signature of the authorized representative and be attached to the SWPPP.
3. All inspection reports shall be signed by the *qualified inspector* that performs the inspection.
4. The MS4 SWPPP Acceptance form shall be signed by the principal executive officer or ranking elected official from the *regulated, traditional land use control MS4*, or by a duly authorized representative of that person.

It shall constitute a permit violation if an incorrect and/or improper signatory authorizes any required forms, SWPPP and/or inspection reports.

I. Property Rights

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations. *Owners or operators* must obtain any applicable conveyances, easements, licenses and/or access to real property prior to *commencing construction activity*.

J. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

K. Requirement to Obtain Coverage Under an Alternative Permit

1. The Department may require any owner or operator authorized by this permit to apply for and/or obtain either an individual SPDES permit or another SPDES general permit. When the Department requires any discharger authorized by a general permit to apply for an individual SPDES permit, it shall notify the discharger in writing that a permit application is required. This notice shall

include a brief statement of the reasons for this decision, an application form, a statement setting a time frame for the owner or operator to file the application for an individual SPDES permit, and a deadline, not sooner than 180 days from owner or operator receipt of the notification letter, whereby the authorization to discharge under this general permit shall be terminated. Applications must be submitted to the appropriate Permit Administrator at the Regional Office. The Department may grant additional time upon demonstration, to the satisfaction of the Department, that additional time to apply for an alternative authorization is necessary or where the Department has not provided a permit determination in accordance with Part 621 of this Title.

2. When an individual SPDES permit is issued to a discharger authorized to *discharge* under a general SPDES permit for the same *discharge(s)*, the general permit authorization for outfalls authorized under the individual SPDES permit is automatically terminated on the effective date of the individual permit unless termination is earlier in accordance with 6 NYCRR Part 750.

L. Proper Operation and Maintenance

The *owner or operator* shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the *owner or operator* to achieve compliance with the conditions of this permit and with the requirements of the SWPPP.

M. Inspection and Entry

The *owner or operator* shall allow an authorized representative of the Department, EPA, applicable county health department, or, in the case of a *construction site* which *discharges* through an *MS4*, an authorized representative of the *MS4* receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the owner's or operator's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;
2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit; and

3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment), practices or operations regulated or required by this permit.
4. Sample or monitor at reasonable times, for purposes of assuring permit compliance or as otherwise authorized by the Act or ECL, any substances or parameters at any location.

N. Permit Actions

This permit may, at any time, be modified, suspended, revoked, or renewed by the Department in accordance with 6 NYCRR Part 621. The filing of a request by the *owner or operator* for a permit modification, revocation and reissuance, termination, a notification of planned changes or anticipated noncompliance does not limit, diminish and/or stay compliance with any terms of this permit.

O. Definitions

Definitions of key terms are included in Appendix A of this permit.

P. Re-Opener Clause

1. If there is evidence indicating potential or realized impacts on water quality due to any stormwater discharge associated with construction activity covered by this permit, the owner or operator of such discharge may be required to obtain an individual permit or alternative general permit in accordance with Part VII.K. of this permit or the permit may be modified to include different limitations and/or requirements.
2. Any Department initiated permit modification, suspension or revocation will be conducted in accordance with 6 NYCRR Part 621, 6 NYCRR 750-1.18, and 6 NYCRR 750-1.20.

Q. Penalties for Falsification of Forms and Reports

In accordance with 6NYCRR Part 750-2.4 and 750-2.5, any person who knowingly makes any false material statement, representation, or certification in any application, record, report or other document filed or required to be maintained under this permit, including reports of compliance or noncompliance shall, upon conviction, be punished in accordance with ECL §71-1933 and or Articles 175 and 210 of the New York State Penal Law.

R. Other Permits

Nothing in this permit relieves the *owner or operator* from a requirement to obtain any other permits required by law.

APPENDIX A – Acronyms and Definitions

Acronyms

APO – Agency Preservation Officer

BMP – Best Management Practice

CPESC – Certified Professional in Erosion and Sediment Control

Cpv – Channel Protection Volume

CWA – Clean Water Act (or the Federal Water Pollution Control Act, 33 U.S.C. §1251 et seq)

DOW – Division of Water

EAF – Environmental Assessment Form

ECL - Environmental Conservation Law

EPA – U. S. Environmental Protection Agency

HSG – Hydrologic Soil Group

MS4 – Municipal Separate Storm Sewer System

NOI – Notice of Intent

NOT – Notice of Termination

NPDES – National Pollutant Discharge Elimination System

OPRHP – Office of Parks, Recreation and Historic Places

Qf – Extreme Flood

Qp – Overbank Flood

RRv – Runoff Reduction Volume

RWE – Regional Water Engineer

SEQR – State Environmental Quality Review

SEQRA - State Environmental Quality Review Act

SHPA – State Historic Preservation Act

SPDES – State Pollutant Discharge Elimination System

SWPPP – Stormwater Pollution Prevention Plan

TMDL – Total Maximum Daily Load

UPA – Uniform Procedures Act

USDA – United States Department of Agriculture

WQv – Water Quality Volume

Definitions

All definitions in this section are solely for the purposes of this permit.

Agricultural Building – a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products; excluding any structure designed, constructed or used, in whole or in part, for human habitation, as a place of employment where agricultural products are processed, treated or packaged, or as a place used by the public.

Agricultural Property – means the land for construction of a barn, *agricultural building*, silo, stockyard, pen or other structural practices identified in Table II in the “Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State” prepared by the Department in cooperation with agencies of New York Nonpoint Source Coordinating Committee (dated June 2007).

Alter Hydrology from Pre to Post-Development Conditions - means the post-development peak flow rate(s) has increased by more than 5% of the pre-developed condition for the design storm of interest (e.g. 10 yr and 100 yr).

Combined Sewer - means a sewer that is designed to collect and convey both “sewage” and “stormwater”.

Commence (Commencement of) Construction Activities - means the initial disturbance of soils associated with clearing, grading or excavation activities; or other construction related activities that disturb or expose soils such as demolition, stockpiling of fill material, and the initial installation of erosion and sediment control practices required in the SWPPP. See definition for “*Construction Activity(ies)*” also.

Construction Activity(ies) - means any clearing, grading, excavation, filling, demolition or stockpiling activities that result in soil disturbance. Clearing activities can include, but are not limited to, logging equipment operation, the cutting and skidding of trees, stump removal and/or brush root removal. Construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

Construction Site – means the land area where *construction activity(ies)* will occur. See definition for “*Commence (Commencement of) Construction Activities*” and “*Larger Common Plan of Development or Sale*” also.

Dewatering – means the act of draining rainwater and/or groundwater from building foundations, vaults or excavations/trenches.

Direct Discharge (to a specific surface waterbody) - means that runoff flows from a *construction site* by overland flow and the first point of discharge is the specific surface waterbody, or runoff flows from a *construction site* to a separate storm sewer system

and the first point of discharge from the separate storm sewer system is the specific surface waterbody.

Discharge(s) - means any addition of any pollutant to waters of the State through an outlet or *point source*.

Embankment –means an earthen or rock slope that supports a road/highway.

Endangered or Threatened Species – see 6 NYCRR Part 182 of the Department’s rules and regulations for definition of terms and requirements.

Environmental Conservation Law (ECL) - means chapter 43-B of the Consolidated Laws of the State of New York, entitled the Environmental Conservation Law.

Equivalent (Equivalence) – means that the practice or measure meets all the performance, longevity, maintenance, and safety objectives of the technical standard and will provide an equal or greater degree of water quality protection.

Final Stabilization - means that all soil disturbance activities have ceased and a uniform, perennial vegetative cover with a density of eighty (80) percent over the entire pervious surface has been established; or other equivalent stabilization measures, such as permanent landscape mulches, rock rip-rap or washed/crushed stone have been applied on all disturbed areas that are not covered by permanent structures, concrete or pavement.

General SPDES permit - means a SPDES permit issued pursuant to 6 NYCRR Part 750-1.21 and Section 70-0117 of the ECL authorizing a category of discharges.

Groundwater(s) - means waters in the saturated zone. The saturated zone is a subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere. Although the zone may contain gas-filled interstices or interstices filled with fluids other than water, it is still considered saturated.

Historic Property – means any building, structure, site, object or district that is listed on the State or National Registers of Historic Places or is determined to be eligible for listing on the State or National Registers of Historic Places.

Impervious Area (Cover) - means all impermeable surfaces that cannot effectively infiltrate rainfall. This includes paved, concrete and gravel surfaces (i.e. parking lots, driveways, roads, runways and sidewalks); building rooftops and miscellaneous impermeable structures such as patios, pools, and sheds.

Infeasible – means not technologically possible, or not economically practicable and achievable in light of best industry practices.

Larger Common Plan of Development or Sale - means a contiguous area where multiple separate and distinct *construction activities* are occurring, or will occur, under one plan. The term “plan” in “larger common plan of development or sale” is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, marketing plan, advertisement, drawing, permit application, State Environmental Quality Review Act (SEQRA) environmental assessment form or other documents, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating that *construction activities* may occur on a specific plot.

For discrete construction projects that are located within a larger common plan of development or sale that are at least 1/4 mile apart, each project can be treated as a separate plan of development or sale provided any interconnecting road, pipeline or utility project that is part of the same “common plan” is not concurrently being disturbed.

Minimize – means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practices.

Municipal Separate Storm Sewer (MS4) - a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to surface waters of the State;
- (ii) Designed or used for collecting or conveying stormwater;
- (iii) Which is not a *combined sewer*, and
- (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES) - means the national system for the issuance of wastewater and stormwater permits under the Federal Water Pollution Control Act (Clean Water Act).

Natural Buffer –means an undisturbed area with natural cover running along a surface water (e.g. wetland, stream, river, lake, etc.).

New Development – means any land disturbance that does not meet the definition of Redevelopment Activity included in this appendix.

New York State Erosion and Sediment Control Certificate Program – a certificate program that establishes and maintains a process to identify and recognize individuals who are capable of developing, designing, inspecting and maintaining erosion and sediment control plans on projects that disturb soils in New York State. The certificate program is administered by the New York State Conservation District Employees Association.

NOI Acknowledgment Letter - means the letter that the Department sends to an owner or operator to acknowledge the Department's receipt and acceptance of a complete Notice of Intent. This letter documents the owner's or operator's authorization to discharge in accordance with the general permit for stormwater discharges from *construction activity*.

Nonpoint Source - means any source of water pollution or pollutants which is not a discrete conveyance or *point source* permitted pursuant to Title 7 or 8 of Article 17 of the Environmental Conservation Law (see ECL Section 17-1403).

Overbank –means flow events that exceed the capacity of the stream channel and spill out into the adjacent floodplain.

Owner or Operator - means the person, persons or legal entity which owns or leases the property on which the *construction activity* is occurring; an entity that has operational control over the construction plans and specifications, including the ability to make modifications to the plans and specifications; and/or an entity that has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions.

Performance Criteria – means the design criteria listed under the “Required Elements” sections in Chapters 5, 6 and 10 of the technical standard, New York State Stormwater Management Design Manual, dated January 2015. It does not include the Sizing Criteria (i.e. WQv, RRv, Cpv, Qp and Qf) in Part I.C.2. of the permit.

Point Source - means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel or other floating craft, or landfill leachate collection system from which *pollutants* are or may be discharged.

Pollutant - means dredged spoil, filter backwash, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand and industrial, municipal, agricultural waste and ballast discharged into water; which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards or guidance values adopted as provided in 6 NYCRR Parts 700 et seq .

Qualified Inspector - means a person that is knowledgeable in the principles and practices of erosion and sediment control, such as a licensed Professional Engineer, Certified Professional in Erosion and Sediment Control (CPESC), Registered Landscape Architect, New York State Erosion and Sediment Control Certificate Program holder or other Department endorsed individual(s).

It can also mean someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided that person has training in the principles and practices of erosion and sediment control. Training in the principles and practices of erosion and sediment control means that the individual working under the direct supervision of the licensed Professional Engineer or Registered Landscape Architect has received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity. After receiving the initial training, the individual working under the direct supervision of the licensed Professional Engineer or Registered Landscape Architect shall receive four (4) hours of training every three (3) years.

It can also mean a person that meets the *Qualified Professional* qualifications in addition to the *Qualified Inspector* qualifications.

Note: Inspections of any post-construction stormwater management practices that include structural components, such as a dam for an impoundment, shall be performed by a licensed Professional Engineer.

Qualified Professional - means a person that is knowledgeable in the principles and practices of stormwater management and treatment, such as a licensed Professional Engineer, Registered Landscape Architect or other Department endorsed individual(s). Individuals preparing SWPPPs that require the post-construction stormwater management practice component must have an understanding of the principles of hydrology, water quality management practice design, water quantity control design, and, in many cases, the principles of hydraulics. All components of the SWPPP that involve the practice of engineering, as defined by the NYS Education Law (see Article 145), shall be prepared by, or under the direct supervision of, a professional engineer licensed to practice in the State of New York.

Redevelopment Activity(ies) – means the disturbance and reconstruction of existing impervious area, including impervious areas that were removed from a project site within five (5) years of preliminary project plan submission to the local government (i.e. site plan, subdivision, etc.).

Regulated, Traditional Land Use Control MS4 - means a city, town or village with land use control authority that is authorized to discharge under New York State DEC's

SPDES General Permit For Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s) or the City of New York's Individual SPDES Permit for their Municipal Separate Storm Sewer Systems (NY-0287890).

Routine Maintenance Activity - means *construction activity* that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility, including, but not limited to:

- Re-grading of gravel roads or parking lots,
- Cleaning and shaping of existing roadside ditches and culverts that maintains the approximate original line and grade, and hydraulic capacity of the ditch,
- Cleaning and shaping of existing roadside ditches that does not maintain the approximate original grade, hydraulic capacity and purpose of the ditch if the changes to the line and grade, hydraulic capacity or purpose of the ditch are installed to improve water quality and quantity controls (e.g. installing grass lined ditch),
- Placement of aggregate shoulder backing that stabilizes the transition between the road shoulder and the ditch or *embankment*,
- Full depth milling and filling of existing asphalt pavements, replacement of concrete pavement slabs, and similar work that does not expose soil or disturb the bottom six (6) inches of subbase material,
- Long-term use of equipment storage areas at or near highway maintenance facilities,
- Removal of sediment from the edge of the highway to restore a previously existing sheet-flow drainage connection from the highway surface to the highway ditch or *embankment*,
- Existing use of Canal Corp owned upland disposal sites for the canal, and
- Replacement of curbs, gutters, sidewalks and guide rail posts.

Site limitations – means site conditions that prevent the use of an infiltration technique and or infiltration of the total WQv. Typical site limitations include: seasonal high groundwater, shallow depth to bedrock, and soils with an infiltration rate less than 0.5 inches/hour. The existence of site limitations shall be confirmed and documented using actual field testing (i.e. test pits, soil borings, and infiltration test) or using information from the most current United States Department of Agriculture (USDA) Soil Survey for the County where the project is located.

Sizing Criteria – means the criteria included in Part I.C.2 of the permit that are used to size post-construction stormwater management control practices. The criteria include; Water Quality Volume (WQv), Runoff Reduction Volume (RRv), Channel Protection Volume (Cpv), *Overbank Flood* (Qp), and *Extreme Flood* (Qf).

State Pollutant Discharge Elimination System (SPDES) - means the system established pursuant to Article 17 of the ECL and 6 NYCRR Part 750 for issuance of permits authorizing discharges to the waters of the state.

Steep Slope – means land area designated on the current United States Department of Agriculture (“USDA”) Soil Survey as Soil Slope Phase “D”, (provided the map unit name is inclusive of slopes greater than 25%) , or Soil Slope Phase E or F, (regardless of the map unit name), or a combination of the three designations.

Streambank – as used in this permit, means the terrain alongside the bed of a creek or stream. The bank consists of the sides of the channel, between which the flow is confined.

Stormwater Pollution Prevention Plan (SWPPP) – means a project specific report, including construction drawings, that among other things: describes the construction activity(ies), identifies the potential sources of pollution at the *construction site*; describes and shows the stormwater controls that will be used to control the pollutants (i.e. erosion and sediment controls; for many projects, includes post-construction stormwater management controls); and identifies procedures the *owner or operator* will implement to comply with the terms and conditions of the permit. See Part III of the permit for a complete description of the information that must be included in the SWPPP.

Surface Waters of the State - shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic ocean within the territorial seas of the state of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface waters), which are wholly or partially within or bordering the state or within its jurisdiction. Waters of the state are further defined in 6 NYCRR Parts 800 to 941.

Temporarily Ceased – means that an existing disturbed area will not be disturbed again within 14 calendar days of the previous soil disturbance.

Temporary Stabilization - means that exposed soil has been covered with material(s) as set forth in the technical standard, New York Standards and Specifications for Erosion and Sediment Control, to prevent the exposed soil from eroding. The materials can include, but are not limited to, mulch, seed and mulch, and erosion control mats (e.g. jute twisted yarn, excelsior wood fiber mats).

Total Maximum Daily Loads (TMDLs) - A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and *nonpoint sources*. It is a calculation of the maximum amount of a pollutant that a waterbody can receive on a daily basis and still meet *water quality standards*, and an allocation of that amount to the pollutant's sources. A TMDL stipulates wasteload allocations (WLAs) for *point source* discharges, load allocations (LAs) for *nonpoint sources*, and a margin of safety (MOS).

Trained Contractor - means an employee from the contracting (construction) company, identified in Part III.A.6., that has received four (4) hours of Department endorsed

training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity. After receiving the initial training, the *trained contractor* shall receive four (4) hours of training every three (3) years.

It can also mean an employee from the contracting (construction) company, identified in Part III.A.6., that meets the *qualified inspector* qualifications (e.g. licensed Professional Engineer, Certified Professional in Erosion and Sediment Control (CPESC), Registered Landscape Architect, New York State Erosion and Sediment Control Certificate Program holder, or someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided they have received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity).

The *trained contractor* is responsible for the day to day implementation of the SWPPP.

Uniform Procedures Act (UPA) Permit - means a permit required under 6 NYCRR Part 621 of the Environmental Conservation Law (ECL), Article 70.

Water Quality Standard - means such measures of purity or quality for any waters in relation to their reasonable and necessary use as promulgated in 6 NYCRR Part 700 et seq.

APPENDIX B – Required SWPPP Components by Project Type

Table 1
Construction Activities that Require the Preparation of a SWPPP That Only Includes Erosion and Sediment Controls

<p>The following construction activities that involve soil disturbances of one (1) or more acres of land, but less than five (5) acres:</p> <ul style="list-style-type: none">• Single family home <u>not</u> located in one of the watersheds listed in Appendix C or <u>not directly discharging</u> to one of the 303(d) segments listed in Appendix E• Single family residential subdivisions with 25% or less impervious cover at total site build-out and <u>not</u> located in one of the watersheds listed in Appendix C and <u>not</u> directly discharging to one of the 303(d) segments listed in Appendix E• Construction of a barn or other <i>agricultural building</i>, silo, stock yard or pen.
<p>The following construction activities that involve soil disturbances between five thousand (5000) square feet and one (1) acre of land:</p> <p>All construction activities located in the watersheds identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.</p>
<p>The following construction activities that involve soil disturbances of one (1) or more acres of land:</p> <ul style="list-style-type: none">• Installation of underground, linear utilities; such as gas lines, fiber-optic cable, cable TV, electric, telephone, sewer mains, and water mains• Environmental enhancement projects, such as wetland mitigation projects, stormwater retrofits and stream restoration projects• Pond construction• Linear bike paths running through areas with vegetative cover, including bike paths surfaced with an impervious cover• Cross-country ski trails and walking/hiking trails• Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are not part of residential, commercial or institutional development;• Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that include incidental shoulder or curb work along an existing highway to support construction of the sidewalk, bike path or walking path.• Slope stabilization projects• Slope flattening that changes the grade of the site, but does not significantly change the runoff characteristics

Table 1 (Continued) CONSTRUCTION ACTIVITIES THAT REQUIRE THE PREPARATION OF A SWPPP THAT ONLY INCLUDES EROSION AND SEDIMENT CONTROLS

The following construction activities that involve soil disturbances of one (1) or more acres of land:

- Spoil areas that will be covered with vegetation
- Vegetated open space projects (i.e. recreational parks, lawns, meadows, fields, downhill ski trails) excluding projects that *alter hydrology from pre to post development* conditions,
- Athletic fields (natural grass) that do not include the construction or reconstruction of *impervious area* and do not *alter hydrology from pre to post development* conditions
- Demolition project where vegetation will be established, and no redevelopment is planned
- Overhead electric transmission line project that does not include the construction of permanent access roads or parking areas surfaced with *impervious cover*
- Structural practices as identified in Table II in the “Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State”, excluding projects that involve soil disturbances of greater than five acres and construction activities that include the construction or reconstruction of impervious area
- Temporary access roads, median crossovers, detour roads, lanes, or other temporary impervious areas that will be restored to pre-construction conditions once the construction activity is complete

Table 2
CONSTRUCTION ACTIVITIES THAT REQUIRE THE PREPARATION OF A SWPPP THAT INCLUDES
POST-CONSTRUCTION STORMWATER MANAGEMENT PRACTICES

The following construction activities that involve soil disturbances of one (1) or more acres of land:

- Single family home located in one of the watersheds listed in Appendix C or *directly discharging* to one of the 303(d) segments listed in Appendix E
- Single family home that disturbs five (5) or more acres of land
- Single family residential subdivisions located in one of the watersheds listed in Appendix C or *directly discharging* to one of the 303(d) segments listed in Appendix E
- Single family residential subdivisions that involve soil disturbances of between one (1) and five (5) acres of land with greater than 25% impervious cover at total site build-out
- Single family residential subdivisions that involve soil disturbances of five (5) or more acres of land, and single family residential subdivisions that involve soil disturbances of less than five (5) acres that are part of a larger common plan of development or sale that will ultimately disturb five or more acres of land
- Multi-family residential developments; includes duplexes, townhomes, condominiums, senior housing complexes, apartment complexes, and mobile home parks
- Airports
- Amusement parks
- Breweries, cideries, and wineries, including establishments constructed on agricultural land
- Campgrounds
- Cemeteries that include the construction or reconstruction of impervious area (>5% of disturbed area) or *alter the hydrology from pre to post development* conditions
- Commercial developments
- Churches and other places of worship
- Construction of a barn or other *agricultural building* (e.g. silo) and structural practices as identified in Table II in the "Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State" that include the construction or reconstruction of *impervious area*, excluding projects that involve soil disturbances of less than five acres.
- Golf courses
- Institutional development; includes hospitals, prisons, schools and colleges
- Industrial facilities; includes industrial parks
- Landfills
- Municipal facilities; includes highway garages, transfer stations, office buildings, POTW's, water treatment plants, and water storage tanks
- Office complexes
- Playgrounds that include the construction or reconstruction of impervious area
- Sports complexes
- Racetracks; includes racetracks with earthen (dirt) surface
- Road construction or reconstruction, including roads constructed as part of the construction activities listed in Table 1

Table 2 (Continued)

CONSTRUCTION ACTIVITIES THAT REQUIRE THE PREPARATION OF A SWPPP THAT INCLUDES POST-CONSTRUCTION STORMWATER MANAGEMENT PRACTICES

The following construction activities that involve soil disturbances of one (1) or more acres of land:

- Parking lot construction or reconstruction, including parking lots constructed as part of the construction activities listed in Table 1
- Athletic fields (natural grass) that include the construction or reconstruction of impervious area (>5% of disturbed area) or *alter the hydrology from pre to post development* conditions
- Athletic fields with artificial turf
- Permanent access roads, parking areas, substations, compressor stations and well drilling pads, surfaced with *impervious cover*, and constructed as part of an over-head electric transmission line project, wind-power project, cell tower project, oil or gas well drilling project, sewer or water main project or other linear utility project
- Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a residential, commercial or institutional development
- Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a highway construction or reconstruction project
- All other construction activities that include the construction or reconstruction of *impervious area* or *alter the hydrology from pre to post development* conditions, and are not listed in Table 1

APPENDIX C – Watersheds Requiring Enhanced Phosphorus Removal

Watersheds where *owners or operators* of construction activities identified in Table 2 of Appendix B must prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the Enhanced Phosphorus Removal Standards included in the technical standard, New York State Stormwater Management Design Manual (“Design Manual”).

- Entire New York City Watershed located east of the Hudson River - Figure 1
- Onondaga Lake Watershed - Figure 2
- Greenwood Lake Watershed -Figure 3
- Oscawana Lake Watershed – Figure 4
- Kinderhook Lake Watershed – Figure 5

Figure 1 - New York City Watershed East of the Hudson

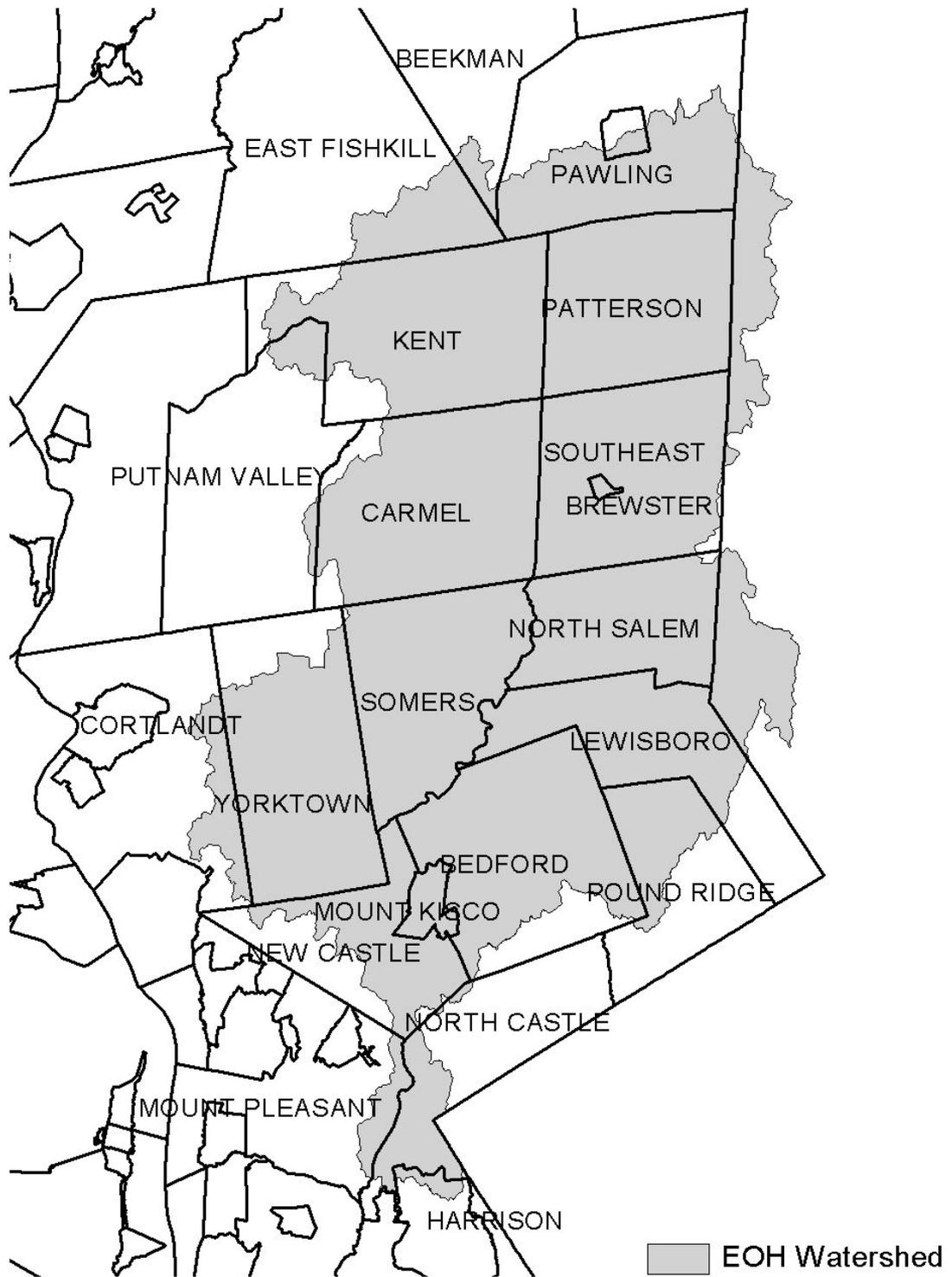


Figure 2 - Onondaga Lake Watershed



Figure 3 - Greenwood Lake Watershed



Figure 4 - Oscawana Lake Watershed

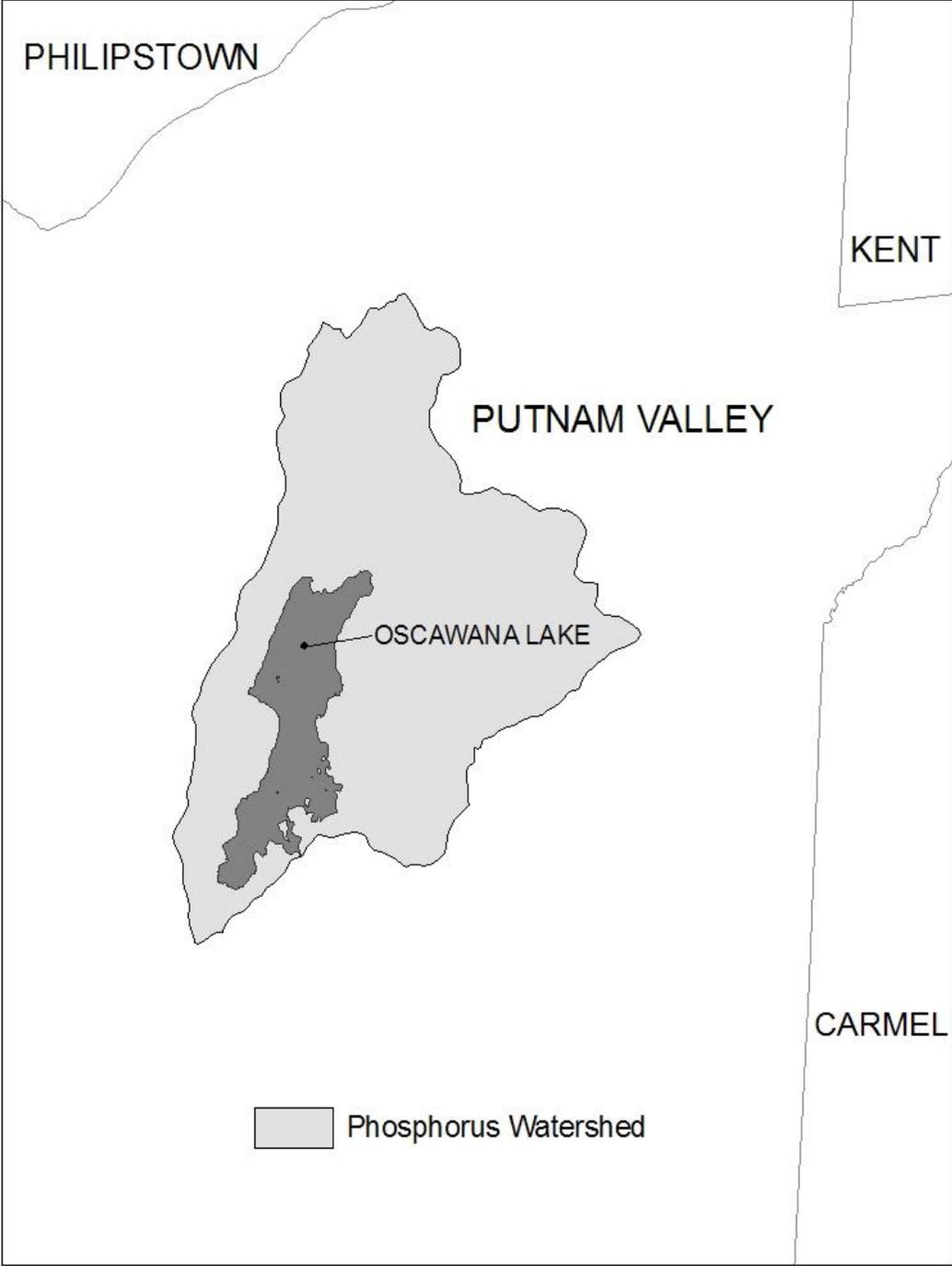
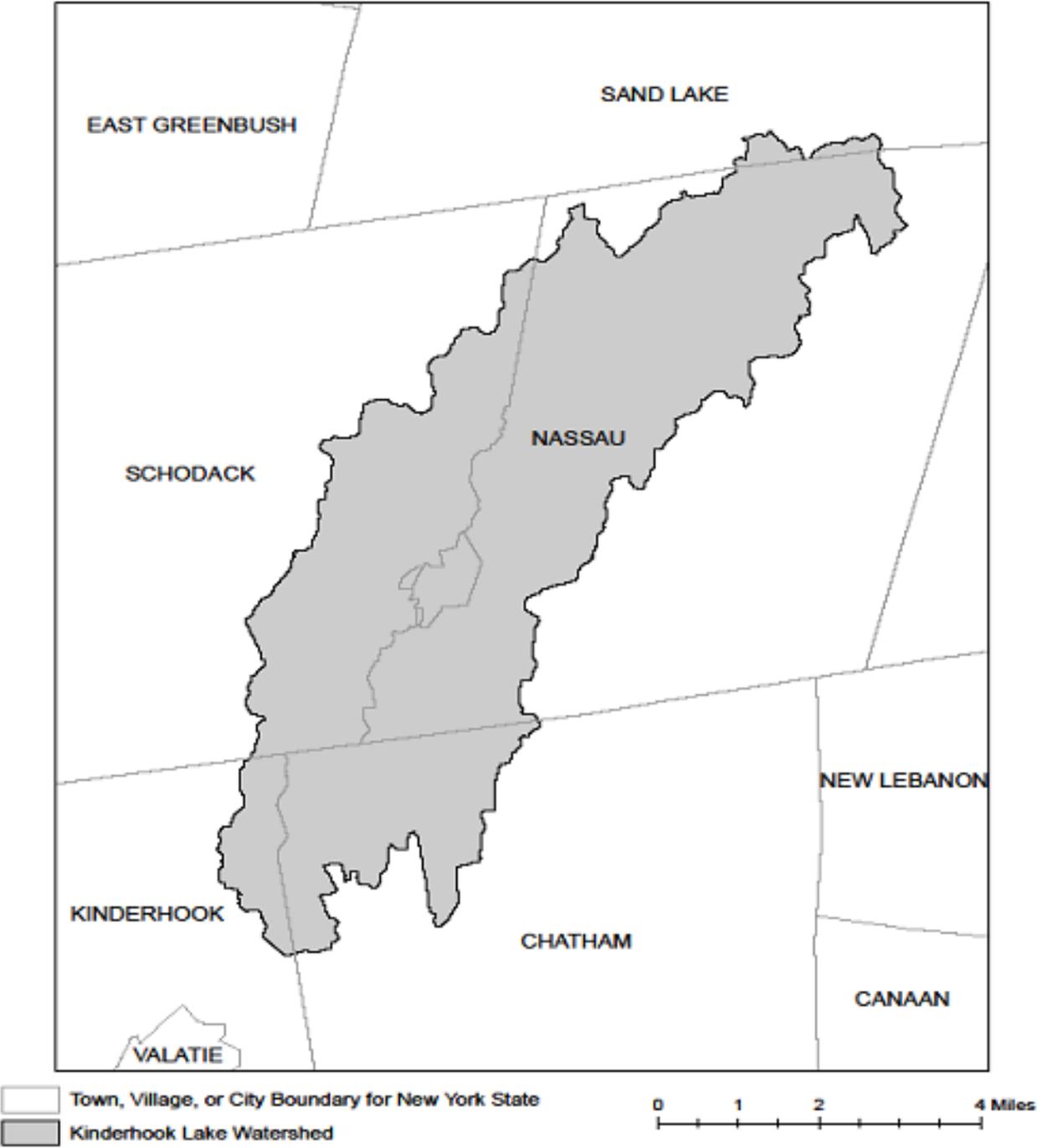


Figure 5 - Kinderhook Lake Watershed



APPENDIX D – Watersheds with Lower Disturbance Threshold

Watersheds where *owners or operators* of construction activities that involve soil disturbances between five thousand (5000) square feet and one (1) acre of land must obtain coverage under this permit.

Entire New York City Watershed that is located east of the Hudson River - See Figure 1 in Appendix C

APPENDIX E – 303(d) Segments Impaired by Construction Related Pollutant(s)

List of 303(d) segments impaired by pollutants related to *construction activity* (e.g. silt, sediment or nutrients). The list was developed using "The Final New York State 2016 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy" dated November 2016. *Owners or operators* of single family home and single family residential subdivisions with 25% or less total impervious cover at total site build-out that involve soil disturbances of one or more acres of land, but less than 5 acres, and *directly discharge* to one of the listed segments below shall prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the New York State Stormwater Management Design Manual ("Design Manual"), dated January 2015.

COUNTY	WATERBODY	POLLUTANT
Albany	Ann Lee (Shakers) Pond, Stump Pond	Nutrients
Albany	Basic Creek Reservoir	Nutrients
Allegany	Amity Lake, Saunders Pond	Nutrients
Bronx	Long Island Sound, Bronx	Nutrients
Bronx	Van Cortlandt Lake	Nutrients
Broome	Fly Pond, Deer Lake, Sky Lake	Nutrients
Broome	Minor Tribs to Lower Susquehanna (north)	Nutrients
Broome	Whitney Point Lake/Reservoir	Nutrients
Cattaraugus	Allegheny River/Reservoir	Nutrients
Cattaraugus	Beaver (Alma) Lake	Nutrients
Cattaraugus	Case Lake	Nutrients
Cattaraugus	Linlyco/Club Pond	Nutrients
Cayuga	Duck Lake	Nutrients
Cayuga	Little Sodus Bay	Nutrients
Chautauqua	Bear Lake	Nutrients
Chautauqua	Chadakoin River and tribs	Nutrients
Chautauqua	Chautauqua Lake, North	Nutrients
Chautauqua	Chautauqua Lake, South	Nutrients
Chautauqua	Findley Lake	Nutrients
Chautauqua	Hulburt/Clymer Pond	Nutrients
Clinton	Great Chazy River, Lower, Main Stem	Silt/Sediment
Clinton	Lake Champlain, Main Lake, Middle	Nutrients
Clinton	Lake Champlain, Main Lake, North	Nutrients
Columbia	Kinderhook Lake	Nutrients
Columbia	Robinson Pond	Nutrients
Cortland	Dean Pond	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Dutchess	Fall Kill and tribs	Nutrients
Dutchess	Hillside Lake	Nutrients
Dutchess	Wappingers Lake	Nutrients
Dutchess	Wappingers Lake	Silt/Sediment
Erie	Beeman Creek and tribs	Nutrients
Erie	Ellicott Creek, Lower, and tribs	Silt/Sediment
Erie	Ellicott Creek, Lower, and tribs	Nutrients
Erie	Green Lake	Nutrients
Erie	Little Sister Creek, Lower, and tribs	Nutrients
Erie	Murder Creek, Lower, and tribs	Nutrients
Erie	Rush Creek and tribs	Nutrients
Erie	Scajaquada Creek, Lower, and tribs	Nutrients
Erie	Scajaquada Creek, Middle, and tribs	Nutrients
Erie	Scajaquada Creek, Upper, and tribs	Nutrients
Erie	South Branch Smoke Cr, Lower, and tribs	Silt/Sediment
Erie	South Branch Smoke Cr, Lower, and tribs	Nutrients
Essex	Lake Champlain, Main Lake, South	Nutrients
Essex	Lake Champlain, South Lake	Nutrients
Essex	Willsboro Bay	Nutrients
Genesee	Bigelow Creek and tribs	Nutrients
Genesee	Black Creek, Middle, and minor tribs	Nutrients
Genesee	Black Creek, Upper, and minor tribs	Nutrients
Genesee	Bowen Brook and tribs	Nutrients
Genesee	LeRoy Reservoir	Nutrients
Genesee	Oak Orchard Cr, Upper, and tribs	Nutrients
Genesee	Tonawanda Creek, Middle, Main Stem	Nutrients
Greene	Schoharie Reservoir	Silt/Sediment
Greene	Sleepy Hollow Lake	Silt/Sediment
Herkimer	Steele Creek tribs	Silt/Sediment
Herkimer	Steele Creek tribs	Nutrients
Jefferson	Moon Lake	Nutrients
Kings	Hendrix Creek	Nutrients
Kings	Prospect Park Lake	Nutrients
Lewis	Mill Creek/South Branch, and tribs	Nutrients
Livingston	Christie Creek and tribs	Nutrients
Livingston	Conesus Lake	Nutrients
Livingston	Mill Creek and minor tribs	Silt/Sediment
Monroe	Black Creek, Lower, and minor tribs	Nutrients
Monroe	Buck Pond	Nutrients
Monroe	Cranberry Pond	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Monroe	Lake Ontario Shoreline, Western	Nutrients
Monroe	Long Pond	Nutrients
Monroe	Mill Creek and tribs	Nutrients
Monroe	Mill Creek/Blue Pond Outlet and tribs	Nutrients
Monroe	Minor Tribs to Irondequoit Bay	Nutrients
Monroe	Rochester Embayment - East	Nutrients
Monroe	Rochester Embayment - West	Nutrients
Monroe	Shipbuilders Creek and tribs	Nutrients
Monroe	Thomas Creek/White Brook and tribs	Nutrients
Nassau	Beaver Lake	Nutrients
Nassau	Camaans Pond	Nutrients
Nassau	East Meadow Brook, Upper, and tribs	Silt/Sediment
Nassau	East Rockaway Channel	Nutrients
Nassau	Grant Park Pond	Nutrients
Nassau	Hempstead Bay	Nutrients
Nassau	Hempstead Lake	Nutrients
Nassau	Hewlett Bay	Nutrients
Nassau	Hog Island Channel	Nutrients
Nassau	Long Island Sound, Nassau County Waters	Nutrients
Nassau	Massapequa Creek and tribs	Nutrients
Nassau	Milburn/Parsonage Creeks, Upp, and tribs	Nutrients
Nassau	Reynolds Channel, west	Nutrients
Nassau	Tidal Tribs to Hempstead Bay	Nutrients
Nassau	Tribs (fresh) to East Bay	Nutrients
Nassau	Tribs (fresh) to East Bay	Silt/Sediment
Nassau	Tribs to Smith/Halls Ponds	Nutrients
Nassau	Woodmere Channel	Nutrients
New York	Harlem Meer	Nutrients
New York	The Lake in Central Park	Nutrients
Niagara	Bergholtz Creek and tribs	Nutrients
Niagara	Hyde Park Lake	Nutrients
Niagara	Lake Ontario Shoreline, Western	Nutrients
Niagara	Lake Ontario Shoreline, Western	Nutrients
Oneida	Ballou, Nail Creeks and tribs	Nutrients
Onondaga	Harbor Brook, Lower, and tribs	Nutrients
Onondaga	Ley Creek and tribs	Nutrients
Onondaga	Minor Tribs to Onondaga Lake	Nutrients
Onondaga	Ninemile Creek, Lower, and tribs	Nutrients
Onondaga	Onondaga Creek, Lower, and tribs	Nutrients
Onondaga	Onondaga Creek, Middle, and tribs	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Onondaga	Onondaga Lake, northern end	Nutrients
Onondaga	Onondaga Lake, southern end	Nutrients
Ontario	Great Brook and minor tribs	Silt/Sediment
Ontario	Great Brook and minor tribs	Nutrients
Ontario	Hemlock Lake Outlet and minor tribs	Nutrients
Ontario	Honeoye Lake	Nutrients
Orange	Greenwood Lake	Nutrients
Orange	Monhagen Brook and tribs	Nutrients
Orange	Orange Lake	Nutrients
Orleans	Lake Ontario Shoreline, Western	Nutrients
Orleans	Lake Ontario Shoreline, Western	Nutrients
Oswego	Lake Neatahwanta	Nutrients
Oswego	Pleasant Lake	Nutrients
Putnam	Bog Brook Reservoir	Nutrients
Putnam	Boyd Corners Reservoir	Nutrients
Putnam	Croton Falls Reservoir	Nutrients
Putnam	Diverting Reservoir	Nutrients
Putnam	East Branch Reservoir	Nutrients
Putnam	Lake Carmel	Nutrients
Putnam	Middle Branch Reservoir	Nutrients
Putnam	Oscawana Lake	Nutrients
Putnam	Palmer Lake	Nutrients
Putnam	West Branch Reservoir	Nutrients
Queens	Bergen Basin	Nutrients
Queens	Flushing Creek/Bay	Nutrients
Queens	Jamaica Bay, Eastern, and tribs (Queens)	Nutrients
Queens	Kissena Lake	Nutrients
Queens	Meadow Lake	Nutrients
Queens	Willow Lake	Nutrients
Rensselaer	Nassau Lake	Nutrients
Rensselaer	Snyders Lake	Nutrients
Richmond	Grasmere Lake/Bradys Pond	Nutrients
Rockland	Congers Lake, Swartout Lake	Nutrients
Rockland	Rockland Lake	Nutrients
Saratoga	Ballston Lake	Nutrients
Saratoga	Dwaas Kill and tribs	Silt/Sediment
Saratoga	Dwaas Kill and tribs	Nutrients
Saratoga	Lake Lonely	Nutrients
Saratoga	Round Lake	Nutrients
Saratoga	Tribs to Lake Lonely	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Schenectady	Collins Lake	Nutrients
Schenectady	Duane Lake	Nutrients
Schenectady	Mariaville Lake	Nutrients
Schoharie	Engleville Pond	Nutrients
Schoharie	Summit Lake	Nutrients
Seneca	Reeder Creek and tribs	Nutrients
St.Lawrence	Black Lake Outlet/Black Lake	Nutrients
St.Lawrence	Fish Creek and minor tribs	Nutrients
Steuben	Smith Pond	Nutrients
Suffolk	Agawam Lake	Nutrients
Suffolk	Big/Little Fresh Ponds	Nutrients
Suffolk	Canaan Lake	Silt/Sediment
Suffolk	Canaan Lake	Nutrients
Suffolk	Flanders Bay, West/Lower Sawmill Creek	Nutrients
Suffolk	Fresh Pond	Nutrients
Suffolk	Great South Bay, East	Nutrients
Suffolk	Great South Bay, Middle	Nutrients
Suffolk	Great South Bay, West	Nutrients
Suffolk	Lake Ronkonkoma	Nutrients
Suffolk	Long Island Sound, Suffolk County, West	Nutrients
Suffolk	Mattituck (Marratooka) Pond	Nutrients
Suffolk	Meetinghouse/Terrys Creeks and tribs	Nutrients
Suffolk	Mill and Seven Ponds	Nutrients
Suffolk	Millers Pond	Nutrients
Suffolk	Moriches Bay, East	Nutrients
Suffolk	Moriches Bay, West	Nutrients
Suffolk	Peconic River, Lower, and tidal tribs	Nutrients
Suffolk	Quantuck Bay	Nutrients
Suffolk	Shinnecock Bay and Inlet	Nutrients
Suffolk	Tidal tribs to West Moriches Bay	Nutrients
Sullivan	Bodine, Montgomery Lakes	Nutrients
Sullivan	Davies Lake	Nutrients
Sullivan	Evens Lake	Nutrients
Sullivan	Pleasure Lake	Nutrients
Tompkins	Cayuga Lake, Southern End	Nutrients
Tompkins	Cayuga Lake, Southern End	Silt/Sediment
Tompkins	Owasco Inlet, Upper, and tribs	Nutrients
Ulster	Ashokan Reservoir	Silt/Sediment
Ulster	Esopus Creek, Upper, and minor tribs	Silt/Sediment
Warren	Hague Brook and tribs	Silt/Sediment

303(d) Segments Impaired by Construction Related Pollutant(s)

Warren	Huddle/Finkle Brooks and tribs	Silt/Sediment
Warren	Indian Brook and tribs	Silt/Sediment
Warren	Lake George	Silt/Sediment
Warren	Tribs to L.George, Village of L George	Silt/Sediment
Washington	Cossayuna Lake	Nutrients
Washington	Lake Champlain, South Bay	Nutrients
Washington	Tribs to L.George, East Shore	Silt/Sediment
Washington	Wood Cr/Champlain Canal and minor tribs	Nutrients
Wayne	Port Bay	Nutrients
Westchester	Amawalk Reservoir	Nutrients
Westchester	Blind Brook, Upper, and tribs	Silt/Sediment
Westchester	Cross River Reservoir	Nutrients
Westchester	Lake Katonah	Nutrients
Westchester	Lake Lincolndale	Nutrients
Westchester	Lake Meahagh	Nutrients
Westchester	Lake Mohegan	Nutrients
Westchester	Lake Shenorock	Nutrients
Westchester	Long Island Sound, Westchester (East)	Nutrients
Westchester	Mamaroneck River, Lower	Silt/Sediment
Westchester	Mamaroneck River, Upper, and minor tribs	Silt/Sediment
Westchester	Muscoot/Upper New Croton Reservoir	Nutrients
Westchester	New Croton Reservoir	Nutrients
Westchester	Peach Lake	Nutrients
Westchester	Reservoir No.1 (Lake Isle)	Nutrients
Westchester	Saw Mill River, Lower, and tribs	Nutrients
Westchester	Saw Mill River, Middle, and tribs	Nutrients
Westchester	Sheldrake River and tribs	Silt/Sediment
Westchester	Sheldrake River and tribs	Nutrients
Westchester	Silver Lake	Nutrients
Westchester	Teatown Lake	Nutrients
Westchester	Titicus Reservoir	Nutrients
Westchester	Truesdale Lake	Nutrients
Westchester	Wallace Pond	Nutrients
Wyoming	Java Lake	Nutrients
Wyoming	Silver Lake	Nutrients

APPENDIX F – List of NYS DEC Regional Offices

<u>Region</u>	<u>COVERING THE FOLLOWING COUNTIES:</u>	<u>DIVISION OF ENVIRONMENTAL PERMITS (DEP) PERMIT ADMINISTRATORS</u>	<u>DIVISION OF WATER (DOW) WATER (SPDES) PROGRAM</u>
1	NASSAU AND SUFFOLK	50 CIRCLE ROAD STONY BROOK, NY 11790 TEL. (631) 444-0365	50 CIRCLE ROAD STONY BROOK, NY 11790-3409 TEL. (631) 444-0405
2	BRONX, KINGS, NEW YORK, QUEENS AND RICHMOND	1 HUNTERS POINT PLAZA, 47-40 21ST ST. LONG ISLAND CITY, NY 11101-5407 TEL. (718) 482-4997	1 HUNTERS POINT PLAZA, 47-40 21ST ST. LONG ISLAND CITY, NY 11101-5407 TEL. (718) 482-4933
3	DUTCHESS, ORANGE, PUTNAM, ROCKLAND, SULLIVAN, ULSTER AND WESTCHESTER	21 SOUTH PUTT CORNERS ROAD NEW PALTZ, NY 12561-1696 TEL. (845) 256-3059	100 HILLSIDE AVENUE, SUITE 1W WHITE PLAINS, NY 10603 TEL. (914) 428 - 2505
4	ALBANY, COLUMBIA, DELAWARE, GREENE, MONTGOMERY, OTSEGO, RENSSELAER, SCHENECTADY AND SCHOHARIE	1150 NORTH WESTCOTT ROAD SCHENECTADY, NY 12306-2014 TEL. (518) 357-2069	1130 NORTH WESTCOTT ROAD SCHENECTADY, NY 12306-2014 TEL. (518) 357-2045
5	CLINTON, ESSEX, FRANKLIN, FULTON, HAMILTON, SARATOGA, WARREN AND WASHINGTON	1115 STATE ROUTE 86, Po Box 296 RAY BROOK, NY 12977-0296 TEL. (518) 897-1234	232 GOLF COURSE ROAD WARRENSBURG, NY 12885-1172 TEL. (518) 623-1200
6	HERKIMER, JEFFERSON, LEWIS, ONEIDA AND ST. LAWRENCE	STATE OFFICE BUILDING 317 WASHINGTON STREET WATERTOWN, NY 13601-3787 TEL. (315) 785-2245	STATE OFFICE BUILDING 207 GENESEE STREET UTICA, NY 13501-2885 TEL. (315) 793-2554
7	BROOME, CAYUGA, CHENANGO, CORTLAND, MADISON, ONONDAGA, OSWEGO, TIOGA AND TOMPKINS	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7438	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7500
8	CHEMUNG, GENESEE, LIVINGSTON, MONROE, ONTARIO, ORLEANS, SCHUYLER, SENECA, STEUBEN, WAYNE AND YATES	6274 EAST AVON-LIMA ROADAVON, NY 14414-9519 TEL. (585) 226-2466	6274 EAST AVON-LIMA RD. AVON, NY 14414-9519 TEL. (585) 226-2466
9	ALLEGANY, CATTARAUGUS, CHAUTAUQUA, ERIE, NIAGARA AND WYOMING	270 MICHIGAN AVENUE BUFFALO, NY 14203-2999 TEL. (716) 851-7165	270 MICHIGAN AVENUE BUFFALO, NY 14203-2999 TEL. (716) 851-7070

Exhibit 5

Waterbodies of Concern

The Town of North Greenbush has worked with The Laberge Group to identify Waterbodies of Concern and Pollutants of Concern that exist throughout the Town. Each of these items, while addressed in separate Exhibits, are closely related, particularly the way in which the Pollutants of Concern affect not only Waterbodies of Concern, but water quality and environmental and public health in general. This Exhibit will concentrate mainly on Waterbodies of Concern, but will slightly reiterate some of the discussion regarding Pollutants of Concern, which are more thoroughly discussed in Exhibit 2.

US EPA Stormwater Background

Stormwater runoff is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm our rivers, streams, lakes, and coastal waters. To protect these resources, communities, construction companies, industries, and others, use stormwater controls, known as Best Management Practices (BMPs). These BMPs filter out pollutants and/or prevent pollution by controlling it at its source.

Population growth and the development of urban/urbanized areas are major contributors to the amount of pollutants in the runoff as well as the volume and rate of runoff from impervious surfaces. Together, they can cause changes in hydrology and water quality that result in habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. The benefits of effective stormwater runoff management can include:

- Protection of wetlands and aquatic ecosystems,
- Improved quality of receiving waterbodies,
- Conservation of water resources,
- Protection of public health, and
- Flood control.

Traditional stormwater management approaches that rely on peak flow storage have generally not targeted pollutant reduction and can exacerbate problems associated with changes in hydrology and hydraulics.

Waterbodies of Concern (WOCs)

The Town watersheds, waterbodies, land uses and Pollutants of Concern (POCs) have been identified based upon a worksheet type analysis. The Town has numerous small streams and water bodies, which drain to primarily four major waterbodies/streams that include:

- Mill Creek:
 - Mill Creek is located within the Wynants Kill watershed.
 - This watershed makes up approximately 12% of the MS4.

- Snyderø Lake:
 - Snyderø Lake is located within the Wynants Kill watershed. The lake is currently included on the NYS 2006 Section 303(d) List of Impaired Waters as a Total Maximum Daily Load (TMDL) designated waterway.
 - This watershed makes up approximately 6% of the MS4.
- Wynants Kill:
 - The Wynants Kill flows to the Hudson River collecting both the Mill Creek and Snyderø Lake watershed discharges.
 - This watershed makes up approximately 53% of the MS4.
- Other Minor Tributaries to the Hudson River:
 - These un-named tributaries flow to the Hudson River.
 - The combined watershed of these un-named tributaries makes up approximately 35% of the MS4.

Pollutants of Concern and Associated Watersheds

The Pollutants of Concern identified in Exhibit 2 affect the Watersheds and Waterbodies of Concern within the Town to varying degrees. The following is a brief outline and summary table correlating the Townø Waterbodies of Concern and Pollutants of Concern.

- Bacteria and Viruses:

Potential sources of stormwater contamination include:

- Animal waste (pets and wildfowl);
- Agriculture site runoff (livestock waste); and
- Septic systems (improperly functioning systems and system breakouts of untreated effluent).

Bacteria and viruses are a concern in the watersheds for:

- Mill Creek;
- Wynants Kill; and
- Tributaries to the Hudson River.

- Gross Solids:

Potential sources of gross solids in stormwater include:

- Improper disposal of garbage;
- Landscape maintenance;

- Animal waste; and
- Street litter.

Gross solids are a concern in the watersheds for:

- Mill Creek;
- Wynants Kill; and
- Tributaries to the Hudson River.

- Nutrients:

Potential sources of phosphorus and nitrogen (nutrients) in stormwater include:

- Chemical fertilizers (residential, commercial, municipal and agricultural applications);
- Detergents (septic systems, car washing);
- Animal waste (pet waste, waterfowl; agricultural land use runoff);
- Soil erosion (phosphorus resides naturally in soils); and
- Atmospheric deposition.

Nutrients are a concern in the watersheds for:

- Mill Creek;
- Wynants Kill;
- Snyderø Lake (part of the Wynants Kill but of particular concern since a TMDL); and
- Tributaries to the Hudson River.

- Pesticides and Herbicides:

Potential sources of pesticides and herbicides in stormwater include:

- Chemicals (residential, commercial, municipal and agricultural applications); and
- Soil erosion.

Pesticides and herbicides are a concern in the watersheds for: :

- Mill Creek;
- Wynants Kill;
- Snyderø Lake; and
- Tributaries to the Hudson River.

- Silt and Sediment:

Potential sources of silt and sediment in stormwater include:

- Soil erosion;
- Road maintenance (winter sanding, regrading, etc.)
- Construction activities;
- Drainage channel erosion; and
- Atmospheric deposition.

Silts and sediments are a concern in the watersheds for:

- Mill Creek;
- Wynants Kill;
- Snyderø Lake; and
- Tributaries to the Hudson River.

- Pools and Fountains:

Potential sources of Pool and Fountain Pollution in stormwater include:

- Pool filter cleaning activities;
- Acid wash pool cleaning; and
- Discharge of chlorinated water during draining.

Pool and Fountain Pollution is applicable to the following watersheds:

- Mill Creek;
- Wynants Kill;
- Snyderø Lake; and
- Tributaries to the Hudson River.

- Organics:

Potential sources of Organics in stormwater include:

- Deliberate dumping of chemicals;
- Improper storage of chemicals; and
- Improper disposal of chemicals.

Organics are applicable to the following watershed:

- Mill Creek;
- Wynants Kill;
- Tributaries to the Hudson River.

- Oil and Grease:

Potential sources of Oil and Grease in stormwater include:

- Poorly maintained vehicles;
- Improper disposal of cooking oil; and
- Spills on impervious areas.

Oil and Grease are a concern in the watersheds for:

- Mill Creek;
- Wynants Kill;
- Tributaries to the Hudson River.

Watershed/Main Tributary to Hudson	Bacteria & Viruses	Gross Solids	Nutrients	Pesticides and Herbicides	Silt and Sediment	Pools (Discharge Water)	Organics	Oil and Grease
Mill Creek	X	X	X	X	X	X	X	X
Wynants Kill	X	X	X	X	X	X	X	X
Snyder's Lake			X	X	X	X		
Unnamed Tributaries to the Hudson River	X	X	X	X	X	X	X	X

Table 1: Town Watersheds and Associated Pollutants of Concern

Best Management Practices

Promoting the health of Waterbodies of Concern can be achieved through the implementation of Best Management Practices (BMPs) on a Town-wide basis. The BMPs currently in use or being developed to address Waterbodies of Concern, and all other waters within the Town, include:

- A Public Education and Outreach Program which discusses the components of stormwater management and the steps that residents, businesses and municipal personnel can take to improve the quality of all bodies of water within the Town.
- A reduction in Pollutants of Concern as discussed in Exhibit 2.
- The implementation of the Illicit Discharge Detection and Elimination Program as discussed in Exhibit 12.

- The regular monitoring of Waterbodies of Concern. The Town does not currently have a specific monitoring and testing program for Waterbodies of Concern, with the exception of Snyders Lake as discussed in Exhibit 6. Until such a program is developed and implemented, the Town will rely on input from residents and municipal personal, most notably in the form observations and the reporting of signs of visible distress within all waterbodies, including Waterbodies of Concern. The Town has developed a Public Concerns Investigation Procedure, which is discussed in detail in Exhibit 6, and will use this tool to record and investigate water quality issues observed and reported by Town residents, business owners, and municipal employees.

Waterbodies of Concern Outreach Audience

Given the number of watersheds (or sub-watersheds) within the Town and the reliance on people within the Town to assist with implementing the BMPs, the Town will target the following audiences:

- Residents, and particularly those individuals who live in close proximity to Waterbodies of Concern;
- Residential developments / Home Owners - Town-wide;
- Commercial businesses and restaurants Town-wide;
- New Construction & landscaping operations Town-wide; and
- Agricultural land use areas - Town-wide.

The MS4 General Permit, MCM 1: Public Education and Outreach, requires outreach to the general public and specific audiences to provide education on:

- The impacts of stormwater discharges on waterbodies;
- WOCs and their associated POCs; and
- Steps that contributors can take to reduce pollutants in stormwater runoff and improve the quality of WOCs.

Outreach efforts will be recorded periodically, assessed, and modified as needed with new, measurable goals established as necessary.

Measurable Goals

The Measurable Goals are applicable on a Town-wide basis. The following are measurable goals that the Town will work toward incorporating in a SWMP Plan update:

- Distribute handouts with information on WOCs and POCs to Town residents. Record the quantity of handouts distributed.
- Track Public Concerns submitted to the Town Stormwater Management Officer.
- Post or otherwise make available stormwater educational materials in other public places.
- Continue with providing educational stormwater pamphlets in routine Town-wide mailings or submitting editorials to local newspapers.

Town of North Greenbush

Rensselaer County

SPDES ID: NYR 20A191



TARGET AUDIENCE ANALYSIS WORKSHEET

A. Identified Watersheds within the Town of North Greenbush

1. Mill Creek
2. Wynants Kill (Lower)
3. Snyder's Lake
4. Tributaries to the Hudson River

MCM 1: Identify Pollutants of Concern (POCs) and Develop and Implement a Public Educational and Outreach Program to describe to the general public and target audiences: (i.) the impacts of *stormwater discharges* on waterbodies; (ii.) *POCs* and their sources; (iii.) steps that contributors of these pollutants can take to reduce pollutants in *stormwater* runoff; and (iv.) steps that contributors of non-*stormwater discharges* can take to reduce pollutants

- Record, periodically assess, and modify as needed, *measurable goals*;
- Select and implement appropriate education and outreach *activities* and *measurable goals* to ensure the reduction of all *POCs* in *stormwater discharges* to the Maximum Extent Possible (*MEP*.)

B. List of Waterbodies of Concern (waterbodies within the identified watersheds) & their best use class

- Use the NYS DEC Waterbody Inventory/Priority Waterbodies List
- Use the NYSDEC online Environmental Resource Mapper to Identify the Best Use Class.

<i>Waterbody</i>	<i>Best Use Class</i>
1. Mill Creek	C (TS) = Non Contact Recreation / Trout Spawning
2. Wynants Kill	C (T) = Non Contact Recreation / Trout Habitat
3. Snyder's Lake	B = Public Swimming & Contact Recreation
4. Tributaries to the Hudson River	C = Non Contact Recreation (fishing)

New York waterbodies are assigned a "best use" classification. Best use classifications are:

- Class AA and A -- drinking water
- Class B -- public swimming and contact recreation activities
- Class C -- fishing and non-contact activities
- Class D -- does not support any of the uses listed above (this classification is rarely used)

Waterbodies with AA, A, B and C classifications may also have "T" or "TS" classifications, meaning they support trout populations or trout spawning.

C. Further refine the waterbodies of concern by listing them under the best use and indicate if they are Impaired with minor impacts, threatened, have possible threats or unknown or un-assessed.

- Use NYS DEC Water Inventory (WI) & Priority Waterbody List (PWL)

Additional Refinement of Waterbodies Best Use (Waterbody: WI/PWL classification)

A = Drinking	A (T) = Drinking Trout Habitat	A (TS) = Drinking /Trout Spawning Habitat	B = Contact Recreation (Swimming)	B (T) = Contact Recreation /Trout Habitat	C = Non Contact Recreation (Fishing)	C (T) = Non Contact Recreation (Trout Habitat)	C (TS) = Non Contact Recreation (Trout Spawning Habitat)	D = Lowest Classification
			<u>Snyder's Lake</u> Category: Minor impacts		<u>Tributaries to the Hudson River</u> Category: Un-assessed	<u>Wynants Kill</u> Category: Minor impacts	<u>Mill Creek</u> Category: No known impact	
			<u>Uses Impacted:</u> Recreation		<u>Uses Impacted:</u> None listed	<u>Uses Impacted:</u> Aquatic life	<u>Uses Impacted:</u> No use impairment	
			<u>Pollutants:</u> Algal/weed growth, nutrients (phosphorous)		<u>Pollutants:</u> None listed	<u>Pollutants:</u> Nutrients, silt/sediment, metals, priority organics, on-site septic systems, streambank erosion, sediment	<u>Pollutants:</u> None listed	
			<u>Likely Pollutant Source:</u> Nutrient recycling		<u>Likely Pollutant Source:</u> None listed	<u>Likely Pollutant Source:</u> Urban/storm runoff	<u>Likely Pollutant Source:</u> N/A	

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Town of North Greenbush

Rensselaer County

SPDES ID: NYR 20A191



Pollutants of Concern (POC) Worksheet				
Name of Watershed: Mill Creek - Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 2.3 Sq. Mi. 12 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	1%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	6.49%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.01%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	5.93%	PH, N	Homeowners
	Golf Courses/Parks			
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	41.45%	PH, N, BV	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	33.99%		
X	Grassland	0.24%		
X	Wetlands	10.61%		
X	Water-Lakes, Ponds, Streams	0.29%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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Town of North Greenbush

Rensselaer County

SPDES ID: NYR 20A191



Pollutants of Concern (POC) Worksheet				
Name of Watershed: Wynants Kill – Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 10.4 Sq. Mi. 53 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	2%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	15.96%	S, PF, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.45%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	11.57%	PH, N	Homeowners
	Golf Courses/Parks	%		
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	17.30%	PH, N, BV	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	39.43%		
X	Grassland	4.92%		
X	Wetlands	6.06%		
X	Water-Lakes, Ponds, Streams	2.34%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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Town of North Greenbush

Rensselaer County

SPDES ID: NYR 20A191



Pollutants of Concern (POC) Worksheet				
Name of Watershed: Unnamed Tributaries – Hudson River				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 6.8 Sq. Mi. 35 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	3%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	29.07%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	4.44%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
Green Areas				
<i>Man-made:</i>				
X	Lawns/turf	19.28%	PH, N	Homeowners
X	Golf Courses/Parks	0.51%	PH, N	Golf Course
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	18.43%	PH, BV, N	Farms
	Stormwater Management	%		
<i>Natural:</i>				
X	Forest	21.97%		
	Grassland	%		
X	Wetlands	1.93%		
X	Water-Lakes, Ponds, Streams	1.37%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.			
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.			

Pollutants of Concern Table

Likely Pollutant	Prompt Questions	Land Use Category
Bacteria and Viruses (BV)	Septic System Present? Aging Infrastructure? High Concentration of pet waste or goose droppings?	Residential; Lawns/turf; Golf Courses; Livestock
Gross Solids (GS)	Any Restaurants or stores producing trash? High Concentration of poorly maintained dumpsters? Known area for sloppy pick up of trash	Retail
Nutrients (N)	Are there lawns or golf courses using extra fertilizers? Pet Waste? Goose Droppings?	Lawns/Turf; Golf Courses; Agriculture; Office Professional/Office Space/Schools
Organics (O)	Any businesses producing or using paint thinner, solvents, cleaners, etc.	Industrial; Retail
Sediment (S)	Any active construction sites? Parking lots collecting sediments? Catch basins loaded with sediment?	Impervious Pathways; Residential
Pools and Fountains (PF)	High concentration of swimming pools or fountains?	Residential; Parks; Retail
Vectors (V)	Any Stormwater infrastructure with standing water in need of cleaning or maintenance"	Stormwater Management
Thermal Stress (TS)	Are there exposed parking lots or roads near trout streams?	Impervious; Residential; Retail; Industrial
Metals (M)	Any junk/scrap yards or car shops near waterbodies?	Retail; Industrial; Office Professional/Office Space; Residential; Impervious
Pesticides and Herbicides (PH)	High concentration of property owners using lawn care services? Particularly well kept lawns and turf?	Office Professional/Office Space; Residential; Lawns/turf; Golf Courses; Agriculture
Oil and Grease (OG)	High concentration of car repair shops? Food service business or restaurants dumping cooked oil?	Residential; Retail; Impervious

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Town of North Greenbush

Rensselaer County

SPDES ID: NYR 20A191



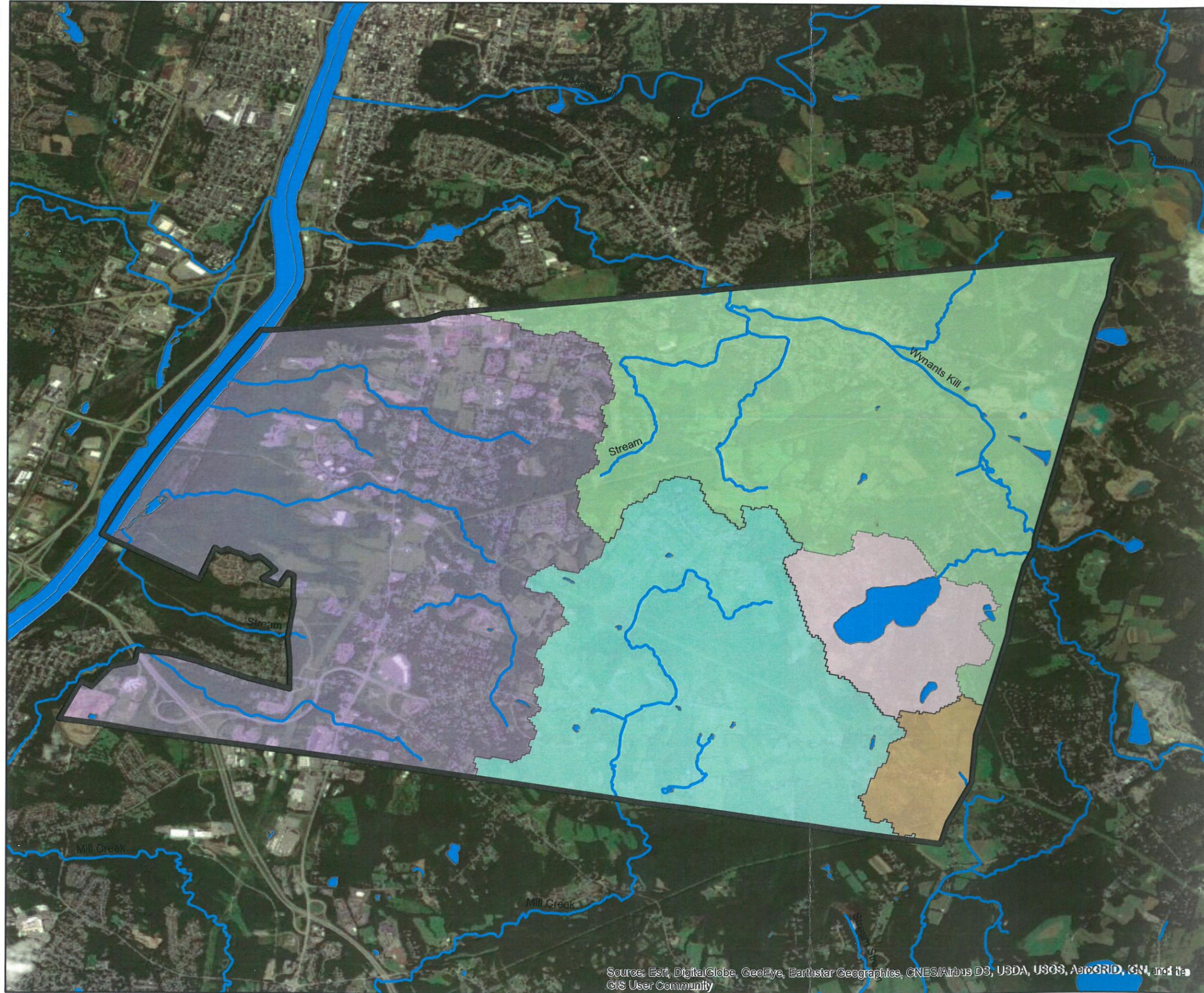
<i>Measurable Goal 1:</i>	Continue with providing educational stormwater pamphlets in routine Town-wide mailings.
<i>Measurable Goal 2:</i>	Post or otherwise make available stormwater educational materials in other public places.

Pollutants of Concern (POC) Worksheet				
Name of Watershed: Snyder's Lake (included in Wynants Kill watershed)				
Total Area of MS4: 19.5 Sq. Mi. Watershed Area = 1.1 Sq. Mi. 6 % of MS4				
	Built Areas	% of Land Use Within Watershed	Possible POCs	Target Audience
X	Impervious (Paths only: Roads, Sidewalks, Parking Lots, Driveways, etc.)	0.5%	S	Town Streets
	Residential (Large lots/1 single family per 1 to 5 acres)	%		
X	Residential (Small lots/1 single family/duplex per 1/8 to 1 acre)	16.05%	PF, S, BV, N	Pool Owners, Contractors, Homes with Septic Systems
	Residential (Apts/multi family 1 building per 1/8 to 1 acre)	%		
X	Retail and/or Mixed Use	0.06%	GS, O, OG	Businesses, Restaurants
	Industrial	%		
	Office Professional/Office Space/Schools/Universities	%		
	<u>Green Areas</u>			
	<i><u>Man-made:</u></i>			
X	Lawns/turf	11.68%	PH, N	Homeowners
	Golf Courses/Parks	%		
	Urban Tree Canopy	%		
X	Agriculture, Livestock, Nurseries, Tree Farms	21.24%	PH, BV, N	Farms
	Stormwater Management	%		
	<i><u>Natural:</u></i>			
X	Forest	31.55%		
X	Grassland	0.85%		
X	Wetlands	2.45%		
X	Water-Lakes, Ponds, Streams	15.6%		
Measurable Goals for this Watershed				
List any Measurable goals to establish that will assist in education for the Target Audience in this Watershed				

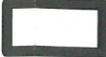
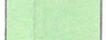
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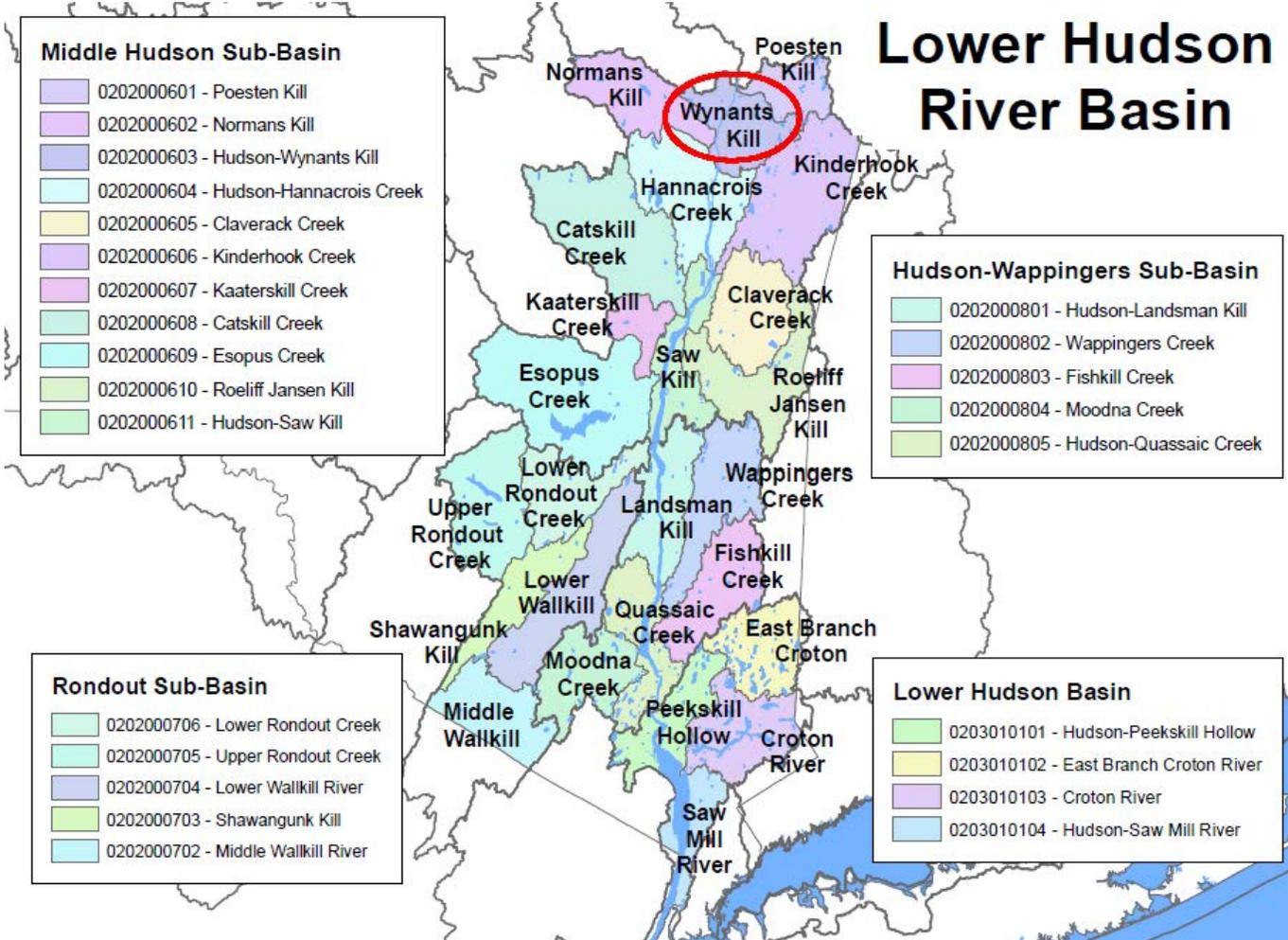
Town of North Greenbush Watershed Map



Legend

-  Town Border
-  Waterbodies
-  Snyder's Lake Watershed
-  Wynants Kill Watershed
-  Mill Creek Watershed
-  North Branch Moordener Kill Watershed
-  Hudson River Tributaries Watershed

Lower Hudson River Basin



Wynants Kill – Hudson River (0202000603)

Water Index Number

H-222 thru 232, EOH (selected)
H-222-P297
H-224
H-226
H-226-P336
H-228a thru 237, WOH
H-231-P355
H-235
H-235
H-235- 8-P374
H-235-11-P377
H-235-13-P382
H-235-P366
H-235-P386
H-235-P386-
H-235-P386- 1- 1-P391
H-235-P386- 1- P397
H-235-P386- 1-P394

Waterbody Name

Minor Tribs to East of Hudson (1301-0245)
Hampton Manor Lake (1301-0077)
Mill Creek and tribs (1301-0246)
Patroon Creek and tribs (1301-0030)
Rensselaer Lake (1301-0247)
Minor Tribs to West of Hudson(1301-0027)
Littles Lake (1301-0248)
Wynants Kill, Lower, and tribs (1301-0066)
Wynants Kill, Upper, and tribs (1301-0249)
Moules Lake (1301-0250)
Snyders Lake (1301-0043)
Racquet Lake (1301-0251)
BurdensPond (1301-0252)
Burdens Lake (1301-0025)
Tribs to Burden Lake(1301-0253)
Crystal Lake (1301-0041)
Crooked Lake (1301-0254)
Glass Lake (1301-0042)

Category

UnAssessed
MinorImpacts
NoKnownImpact
Impaired Seg
UnAssessed
Impaired Seg
UnAssessed
MinorImpacts
NoKnownImpact
UnAssessed
UnAssessed
MinorImpacts
UnAssessed
Need Verific
NoKnownImpact
Need Verific

Mill Creek and tribs (1301-0246)

NoKnownImpct

Waterbody Location Information

Revised: 11/05/2007

Water Index No: H-224
Hydro Unit Code: Str Class: C(TS)
Waterbody Type: River
Waterbody Size: 40.9 Miles
Seg Description: entire stream and tribs
Drain Basin: Lower Hudson River
Reg/County: 4/Rensselaer Co. (42)
Quad Map: TROY SOUTH (K-26-1)

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
NO USE IMPAIRMNT		

Type of Pollutant(s)

Known: ---
Suspected: ---
Possible: ---

Source(s) of Pollutant(s)

Known: ---
Suspected: ---
Possible: ---

Resolution/Management Information

Issue Resolvability: 8 (No Known Use Impairment)
Verification Status: (Not Applicable for Selected RESOLVABILITY)
Lead Agency/Office: n/a
TMDL/303d Status: n/a
Resolution Potential: n/a

Further Details

Water Quality Sampling

A biological (macroinvertebrate) survey of Mill Creek at multiple sites between Rensselaer and Best was conducted in 2001. Sampling results indicated mostly non-impacted water quality conditions. At the most downstream end of the stream in the City of Rensselaer moderate impacts were indicated, likely the result of urban runoff and/or municipal/industrial sources. The assessment of this stream as having No Known Impacts reflects the condition in over 90% of the reach. Impacts in the lower mile of the creek are included in the receiving Hudson River (and tidal tributaries) segment. (DEC/DOW, BWAM/SBU, June 2005)

High turbidity was observed in the lower reach of Mill Creek in 2001. An investigation traced the turbidity to a construction site. Subsequent action by the DEC Regional Office resulted in a SPDES permit for the site, erosion and sedimentation controls and post-construction measures to limit future impacts. (DEC/DOW, BWAM/SBU, June 2005)

Segment Description

This segment includes the entire stream and all tribs. The waters of the stream are Class C,C(TS). Tribs to this reach/segment are also Class C,C(TS). Lower tidal portions of this trib are included with the Hudson Main Stem.

Wynants Kill, Lower, and tribs (1301-0066)

MinorImpacts

Waterbody Location Information

Revised: 11/02/2007

Water Index No: H-235
Hydro Unit Code: 02020006/020 **Str Class:** C(T)
Waterbody Type: River
Waterbody Size: 4.0 Miles
Seg Description: stream and tribs, from mouth to Albia

Drain Basin: Lower Hudson River
Middle Hudson River
Reg/County: 4/Rensselaer Co. (42)
Quad Map: TROY SOUTH (K-26-1)

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
Aquatic Life	Stressed	Suspected

Type of Pollutant(s)

Known: ---
Suspected: NUTRIENTS, SILT/SEDIMENT, Metals, Priority Organics
Possible: ---

Source(s) of Pollutant(s)

Known: ---
Suspected: URBAN/STORM RUNOFF
Possible: On-Site/Septic Syst, Streambank Erosion, Tox/Contam. Sediment, Other Sanitary Disch

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 3 (Cause Identified, Source Unknown)
Lead Agency/Office: ext/WQCC
TMDL/303d Status: n/a

Resolution Potential: Medium

Further Details

Overview

Aquatic life support in Wynants Kill are thought to experience minor impacts due to metals, organics and nutrient loadings from urban runoff, past historical contamination and other nonpoint sources.

Water Quality Sampling

A biological (macroinvertebrate) survey of Wynants Kill at multiple sites between West Sand Lake and Troy was conducted in 2001. Sampling results indicated slightly impacted water quality conditions in the two sites along the lower reach. At these sites urban and municipal inputs as well as more general nonpoint sources were identified as likely source of impacts. Previous sampling at the downstream site in Troy found moderately impacted conditions and elevated levels of metals and PAHs in tissue samples. These contaminants were thought to be the result of past historical contamination and urban runoff. Although aquatic life is supported in the stream, nutrient biotic evaluation indicates impacts are sufficient to stress aquatic life support. (DEC/DOW, BWAM/SBU, Wynants Kill Biological Stream Assessment, February 2002)

Previous Assessment

Previously local agencies have expressed concerns about gravel mining operations, suburban residential growth and other development activities in the Wynants Kill watershed that result in increased sediment loads and thermal changes that may affect the fishery and aesthetics of the stream. The stream appears to satisfactorily support a stocked trout

fishery. However high sediment and turbidity has been noted in the stream. Streambank erosion, urban/stormwater runoff and area landfills have also been cited as possible contributing sources. (Rensselaer County WQCC, 1996)

Segment Description

This segment includes the portion of the stream and all tribs from the mouth to the outlet of unnamed pond (P372) in Albia. The waters of this portion of the stream are Class C,C(T). Tribs to this reach/segment are primarily Class C,C(T),C(TS), with one small trib designated Class A. Upper Wynants Kill is listed separately. Lower tidal portions of this trib are included with the Hudson Main Stem.

Snyders Lake (1301-0043)

MinorImpacts

Waterbody Location Information

Revised: 04/25/2008

Water Index No: H-235-11-P377
Hydro Unit Code: 02020006/020 **Str Class:** B
Waterbody Type: Lake
Waterbody Size: 108.1 Acres
Seg Description: entire lake
Drain Basin: Lower Hudson River
Middle Hudson River
Reg/County: 4/Rensselaer Co. (42)
Quad Map: TROY SOUTH (K-26-1)

Water Quality Problem/Issue Information

(CAPS indicate MAJOR Use Impacts/Pollutants/Sources)

Use(s) Impacted	Severity	Problem Documentation
Recreation	Stressed	Suspected

Type of Pollutant(s)

Known: ALGAL/WEED GROWTH (algal blooms, vegetation)
Suspected: NUTRIENTS (phosphorus)
Possible: D.O./Oxygen Demand

Source(s) of Pollutant(s)

Known: - - -
Suspected: OTHER SOURCE (nutrient recycling)
Possible: - - -

Resolution/Management Information

Issue Resolvability: 1 (Needs Verification/Study (see STATUS))
Verification Status: 4 (Source Identified, Strategy Needed)
Lead Agency/Office: ext/WQCC
TMDL/303d Status: 1/4c->n/a

Resolution Potential: Medium

Further Details

Overview

Recreational uses in Snyders Lake are thought to experience minor impacts due to occasional algal blooms and weed growth related to seasonal phosphorus releases from lake bottom sediments.

Water Quality Sampling

Snyders Lake has been sampled as part of the NYSDEC Citizen Statewide Lake Assessment Program (CSLAP) beginning in 1997 and continuing through 2001. An Interpretive Summary report of the findings of this sampling was published in 2002. These data indicate that the lake continues to be best characterized as mesotrophic, or moderately productive. These conditions have been relatively stable during the sampling period. Phosphorus levels in the lake only occasionally exceed the state guidance values indicating impacted/stressed recreational uses. However corresponding transparency measurements meet what is recommended for swimming beaches. Measurements of pH typically fall within the state water quality range of 6.5 to 8.5; occasional high pH does not appear to result in ecological impacts. (DEC/DOW, BWAM/CSLAP, November 2002)

Recreational Assessment

Public perception of the lake and its uses is also evaluated as part of the CSLAP program. This assessment indicates recreational suitability of the lake to be very favorable since the lake was first evaluated and continuing through the most recent assessment. The recreational suitability of the lake is best characterized as "excellent" to "slightly"

impacted for most uses. The lake itself is most often described as between "not quite crystal clear," an assessment that is consistent with the perceived water quality conditions in the lake and its measured water quality characteristics. More recent assessments have noted that rooted aquatic plants grow to the lake surface but do not impact recreational use. Native and less invasive plants have replaced Eurasian milfoil, a result attributed to 1998 herbicide treatment of the lake. The greatest impact of recreational assessments continues to be sporadic but occasionally intense algal blooms. (DEC/DOW, BWAM/CSLAP, November 2002)

Lake Uses

This lake waterbody is designated class B, suitable for use as a public bathing beach, general recreation and aquatic life support, but not as a water supply. Water quality monitoring by NYSDEC focuses primarily on support of general recreation and aquatic life. Samples to evaluate the bacteriological condition and bathing use of the lake or to evaluate contamination from organic compounds, metals or other inorganic pollutants have not been collected as part of the CSLAP monitoring program. Monitoring to assess public bathing use is generally the responsibility of state and/or local health departments.

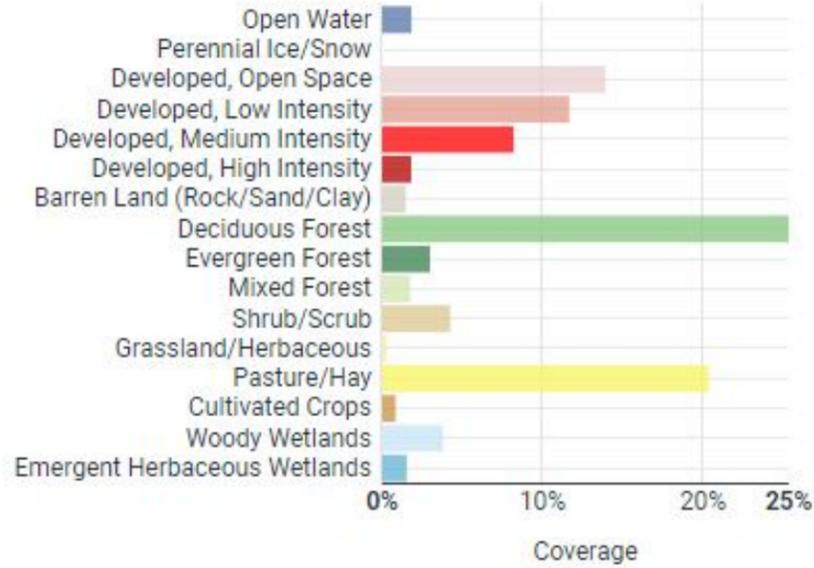
Previous Assessment

Recreational use impacts due to excessive aquatic weed growth and algal blooms, have been cited in previous assessments. Treatment of the lake with aquatic herbicide (Sonar) has been used to control Eurasian milfoil and curly-leaf pondweed. Historically, failing and/or inadequate on-site septic systems serving homes along the lake were a significant sources of water quality impairment. Construction of a sewer system for lakeshore residents to address this source was completed in 1980s. (DEC/DOW, BWAM/SWMS, 2007)

Section 303(d) Listing

Snyders Lake is currently included on the NYS 2006 Section 303(d) List of Impaired Waters. The lake is included on Part 1 of the List as a Water Requiring a TMDL for phosphorus, however this updated assessment indicates that phosphorus levels only occasionally exceed the criteria reflecting stressed recreational uses and along with recreational assessment do not suggests that these impacts to water quality and uses are sufficient to warrant continued listing. (DEC/DOW, BWAM/WQAS, March 2008)

Town of North Greenbush Land Cover Map



Type	Area (km ²)	Coverage (%)
Open Water	0.89	1.76%
Perennial Ice/Snow	0	0.00%
Developed, Open Space	6.87	13.55%
Developed, Low Intensity	5.76	11.36%
Developed, Medium Intensity	4.04	7.97%
Developed, High Intensity	0.9	1.77%
Barren Land (Rock/Sand/Clay)	1.63	3.21%
Deciduous Forest	12.51	24.67%
Evergreen Forest	1.48	2.92%
Mixed Forest	1	1.97%
Shrub/Scrub	2.28	4.50%
Grassland/Herbaceous	0.25	0.49%
Pasture/Hay	10.05	19.82%
Cultivated Crops	0.42	0.83%
Woody Wetlands	1.87	3.69%
Emergent Herbaceous Wetlands	0.76	1.50%
Total	50.71	100.00%

Type	Coverage (%)
Agricultural	±20%
Developed	±33%
Retail/Mixed	±2%
Forests & Wetlands	±40%

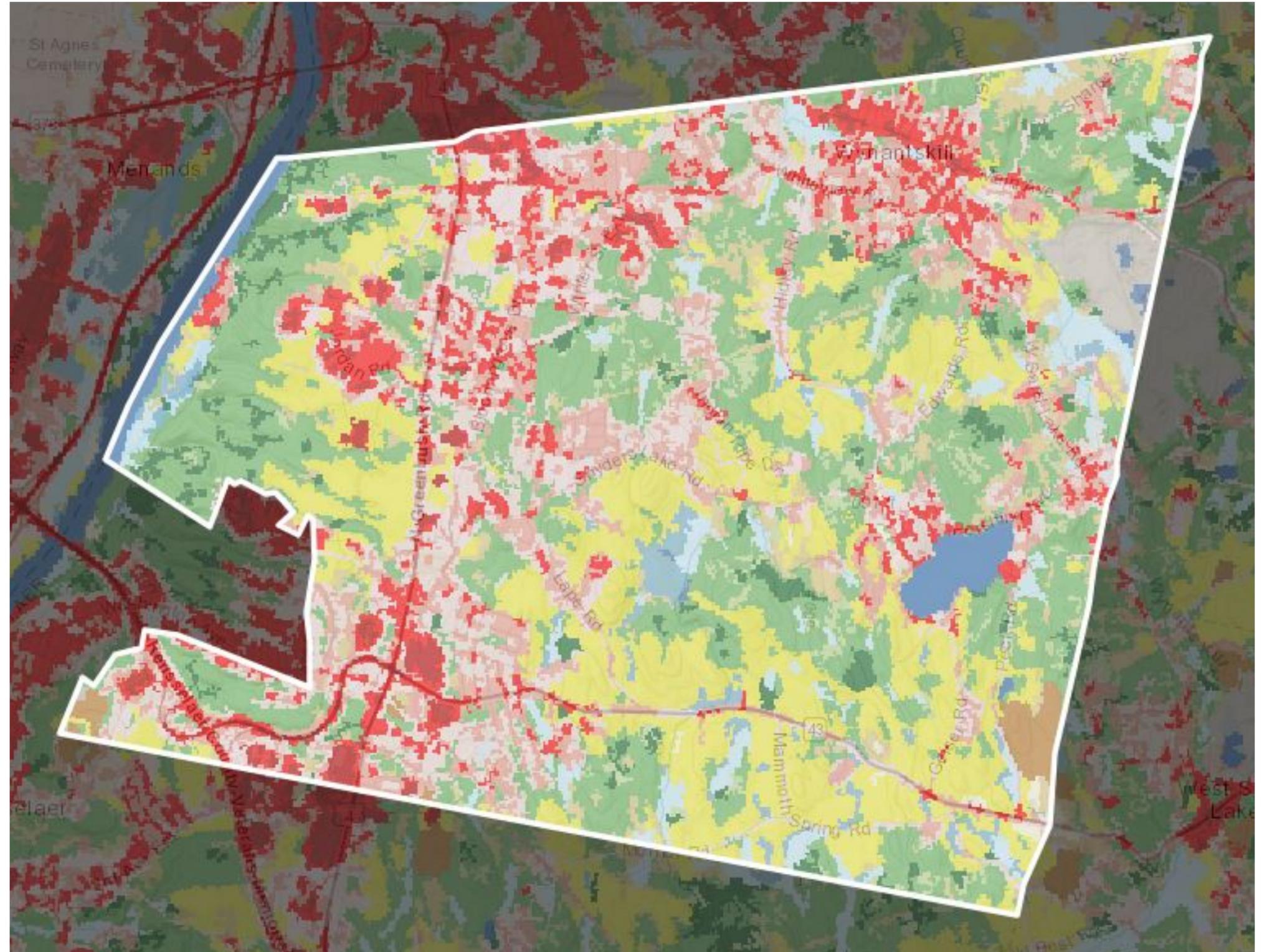


Exhibit 6

Snyders Lake Water Quality and Best Management Practices

Nutrients such as phosphorus and nitrogen can promote the overgrowth of algae, deplete oxygen in the waterway, and be harmful to aquatic life. Bacteria from animal wastes and illicit connections to sewerage systems can make lakes and bays unsafe for wading, swimming, and the propagation of edible shellfish. Oil and grease from automobiles may cause a sheen or other form of physical distress that can make the transfer of oxygen difficult for aquatic organisms. Sediment from construction activities can cloud waterways and interfere with the habitat of living things that depend upon those waters. The careless application of pesticides, herbicides and fertilizers affect the health of living organisms and cause ecosystem imbalances, and litter damages aquatic life, introduces chemical pollution, and diminishes the beauty of waterways.

Under the Federal Clean Water Act (CWA), Section 303(d), each state is required to identify waters within its boundaries that do not meet water quality standards for the waters designated uses as they relate to any given pollutant. The Environmental Protection Agency (EPA), in conjunction with the state, has developed the allowable Total Maximum Daily Load (TMDL) for pollutants violating water quality standards for impaired waterbodies. The TMDL is intended to indicate the maximum amount of a pollutant that the waterbody is able to withstand if it is to continue to meet water quality standards.

Currently, Snyders Lake is listed on the New York State 2016 Section 303(d) List of Impaired Waters Requiring TMDL/Other Strategy with regard to phosphorus. The 2016 List is the currently final document in this regard, with the 2018 List in Draft format and the 2020 List having just closed the Data Solicitation Period. Pages 1, 2 and 7 (the page listing Snyders Lake) are included within this Exhibit.

Also attached to this Exhibit is a report entitled, "Total Maximum Daily Load (TMDL) for Phosphorus in Snyders Lake," dated July 2009, prepared for the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation.

The Best Management Practices (BMPs) for addressing pollutants within Snyders Lake are concentrated in the following areas:

Nutrient Loading

Nutrient loading will be reduced by:

- Stressing the use of fertilizers with reduced or no phosphorus and nitrogen;
- Encouraging the clean-up and proper disposal of pet waste;
- Discouraging concentrated wildfowl congregation;
- Monitoring septic system maintenance and performance, and correcting deficiencies; and
- Monitoring agriculture waste storage areas and their management.

Pesticides and Herbicides

Pesticide and Herbicide loading will be reduced by:

- Reducing or eliminating the use of pesticides and herbicides and seeking alternate control methods; and
- Stressing adherence to manufacturer's instructions regarding their proper applications (time, quantities).

Silt and Sediment

Silt and Sediment loading will be reduced by:

- Using routine maintenance, such as street sweeping, to reduce the amount of sediment and silt that may be washed off driveways and roadways;
- Cleaning out catch basins;
- Limiting the duration of earth disturbance and stabilizing soils upon the cessation of activities; and
- Performing channel stabilization routinely based upon frequent inspections.

The Town of North Greenbush (Town) has adopted a Planning Board, Building Department, and Highway Department philosophy intended to recognize and implement the items discussed above. Additionally, the Town is currently preparing a primer and public education presentation to inform residents of the steps they can take to reduce pollutant loading.

2016 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy

Presented here is the *FINAL New York State 2016 Section 303(d) List of Impaired/TMDL Waters*. The list identifies those waters that do not support appropriate uses and that require development of a Total Maximum Daily Load (TMDL) or other restoration strategy.

This Proposed Final List has been submitted to USEPA for review and approval. A Response Summary addressing public comments received regarding the previously issued Draft List is also available.

The Federal Clean Water Act requires states to periodically assess and report on the quality of waters in their state. Section 303(d) of the Act also requires states to identify *Impaired Waters*, where specific designated uses are not fully supported, and for which the state must consider the development of a *Total Maximum Daily Load (TMDL)* or other strategy to reduce the input of the specific pollutant(s) that restrict waterbody uses, in order to restore and protect such uses. An outline of the process used to monitor and assess the quality of New York State waters is contained in the New York State *Consolidated Assessment and Listing Methodology (CALM)*. The CALM describes the water quality assessment and Section 303(d) listing process in order to improve the consistency of assessment and listing decisions.

The waterbody listings in the New York State Section 303(d) List are grouped into a number of categories. The various categories, or Parts, of the list are outlined below.

The 2016 Section 303(d) List of Impaired Waters Requiring a TMDL

Part 1 Individual Waterbody Segments with Impairments Requiring TMDL Development

These are waters with verified impairments that are expected to be addressed by a segment/pollutant-specific TMDL.

Part 2 Multiple/Categorical Waterbody Segments with Impairment Requiring TMDL Development

These are groups of waters affected by similar causes/sources where a single TMDL may be able to address multiple waters with the same issue. Part 2 is subdivided into:

- a) Waterbody Segments Impaired by Atmospheric Deposition/Acid Rain
- b) Waterbody Segments Impaired due to Fish Consumption Advisories
- c) Waterbody Segments Impaired due to Shellfishing Restrictions

Part 3 Waterbodies for which TMDLs are/may be Deferred

These are waters where the development of a TMDL may be premature and may be deferred pending further verification of the suspected impairment, verification for the cause/pollutant/source, or the evaluation of TMDL alternatives. Part 3 is subdivided into:

- a) Waterbodies Requiring Verification of Impairment
- b) Waterbodies Requiring Verification of Cause/Pollutant/Source
- c) Waterbodies Awaiting Development/Evaluation of Other Restoration Measures

Appendix A ó Smaller Lakes Impaired by Atmospheric Deposition (Acid Rain)

Appendix B ó Listed Waterbodies Not Meeting Dissolved Oxygen Standards

Impaired/Delisted Waters NOT Included on the Section 303(d) List

Not all impaired waters of the state are included on the Section 303(d) List. By definition, the List is to be comprised of impaired waters *that require development of a Total Maximum Daily Load (TMDL) plan*. Although separate from the Section 303(d) List, a compilation of waterbody/pollutants representing those impairments that are not included on the List provides additional information toward understanding listing decisions and clarifies how impairments are considered.

Waterbody Segments Not Listed Because TMDL is Not Necessary (separate list)

A list of *Other Impaired Waterbody Segments Not Listed (on 303(d) List) Because Development of a TMDL is Not Necessary* is available to facilitate the review of Section 303(d) List. The purpose of this supplement is to provide a more comprehensive inventory of waters of the state that do not fully support designated uses and that are considered to be impaired.

Section 303(d) of the Clean Water Act stipulates that impaired waters that do not require a TMDL are not to be included on the Section 303(d) List. There are three (3) justifications for not including an impaired water on the Section 303(d) List:

Category 4a Waters - TMDL development is not necessary because a TMDL has already been established for the segment/pollutant.

Category 4b Waters - TMDL is not necessary because other required control measures are expected to result in restoration in a reasonable period of time.

Category 4c Waters - TMDL is not appropriate because the impairment is the result of pollution, rather than a pollutant that can be allocated through a TMDL.

Waterbody/Pollutant Delisting (separate list)

A separate list of water/pollutant combinations that were included on the previous Section 303(d) List, but that are NOT included on the current List is also available. This listing provides some linkage and continuity between the previous and proposed new Lists. The specific reason why a waterbody/pollutant no longer appears on the List (i.e., delisting action, reassessment, re-segmentation, etc.) is included in this document. Some of these waters (those that have been delisted but that remain *Impaired*) also appear on the list of *Other Impaired Waterbody Segments Not Listed Because Development of a TMDL is Not Necessary*.

Water Index Number	Waterbody Name (WI/PWL ID)	County	Type	Class	Cause/Pollutant	Suspected Source	Year
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Part 1 - Individual Waterbody Segments with Impairment Requiring TMDL Development (cont)

Lower Hudson River Drainage Basin (cont)

H- 31-P44-14-P50- 2-P50a	Lake Shenorock (1302-0083)	Westchester	Lake	B	Phosphorus	Urban/Storm Runoff	2010
H- 31-P44-17-5-P57a	Lake Lincoln Dale (1302-0089)	Westchester	Lake	B	Phosphorus	Onsite WTS, Urban	2002
H- 31-P44-23-P59- 6-P62a	* Lake Ca rmel (1302-0006)	Putnam	Lake	B	Phosphorus	Onsite WTS	2002
H- 31-P44-31- 3-P107a	Lake Katonah (1302-0136)	Westchester	Lake	B	Phosphorus	Urban/Storm Runoff	2012
H- 31-P44-35-P109- 6-13-P115a	Truesdale Lake (1302-0054)	Westchester	Lake	B	Phosphorus	Urban/Storm Runoff	2010
H- 31-P44-54-P128a	Teatown Lake (1302-0150)	Westchester	Lake	B	Phosphorus Urban/Storm Runoff	Urban/Storm Runoff	2010
H- 49a-P160	Lake Meahagh (1301-0053)	Westchester	Lake	C	Phosphorus	Onsite WTS, Urban	2002
H- 55- 1-P165	Wallace Pond (1301-0140)	Westchester	Lake	B	Phosphorus	Urban/Storm Runoff	2010
H- 55-11-P179	Lake Mohegan (1301-0149)	Westchester	Lake	B	Phosphorus	Urban/Storm Runoff	2010
H- 95-10-P345g	Hillside Lake (1304-0001)	Dutchess	Lake	B	Phosphorus	Onsite WTS	2002
H-101-P365	Wappingers Lake (1305-0001)	Dutchess	Lake	B	Phosphorus	Urban/Storm Runoff	1998
H-101-P365	Wappingers Lake (1305-0001)	Dutchess	Lake	B	Silt/Sediment Urban/Storm Runoff	Urban/Storm Runoff	2002
H-114	Fallkill Creek (1301-0087)	Dutchess	River	C	Phosphorus	Urban/Storm Runoff	2002
H-139-13-52	Monhagen Brook and tribs (1306-0074)	Orange	River	C	Phosphorus	Urban/Storm Runoff	2010
H-171-P848	Ashokan Reservoir (1307-0004)	Ulster	Lake(R)	AA(T)	Silt/Sediment Streambank Erosion	Urban/Storm Runoff	2002
H-171-P848-	Esopus Creek, Upper, and minor tribs (1307-0007) ⁸	Ulster	River	A(T)	Silt/Sediment Streambank Erosion	Urban/Storm Runoff	1998
H-188-P902	Robinson Pond (1308-0003)	Columbia	Lake	B(T)	Phosphorus	Agriculture	1998
H-202-P8f	Sleepy Hollow Lake (1301-0059)	Greene	Lake	A	Silt/Sediment Streambank Erosion	Urban/Storm Runoff	2002
H-204- 2- 7-P34	Nassau Lake (1310-0001)	Rensselaer	Lake	B	Phosphorus	Onsite WTS, Urban	2010
H-221- 4- 3	Krumkill Creek, Upper, and tribs (1311-0004)	Albany	River	A	Unknown (biol impacts) Urban Runoff/CSOs	Urban/Storm Runoff	2002
H-221- 4-P270- 1- 9-P276a	Duane Lake (1311-0006)	Schenectady	Lake	B	Phosphorus	Onsite WTS, Urban	2010
H-226	Patroon Creek and tribs (1301-0030)	Albany	River	C	Oxygen Demand ¹ Urban/Storm/CSOs	Urban/Storm/CSOs	2002
H-2228a thru 237	Minor Tribs to West of Hudson (1301-0027) ⁹	Albany	River	D>C	Unknown (biol impacts) Industrial	Industrial	2002
H-235-11-P377	Snyders Lake (1301-0043)	Rensselaer	Lake	B	Phosphorus	Oxygen Demand Sed.	2002

Delaware River Drainage Basin

D- 1-35-P38c	Davies Lake (1402-0047)	Sullivan	Lake	B	Phosphorus	Unknown	2014
D- 1-38-P45	Pleasure Lake (1402-0055)	Sullivan	Lake	B	Phosphorus	Unknown	2014
D- 1-38-P50a	Evans Lake (1402-0004)	Sullivan	Lake	B	Phosphorus	Municipal	2016
D-10-22-P128	Swan Lake (1401-0063)	Sullivan	Lake	B	Phosphorus	Unknown	2012
D-30- 2-P185,P186	Bodine, Montgomery Lakes (1401-0091)	Sullivan	Lake	B	Phosphorus	Unknown	2012
D-71-10- 6-P388,P389	Fly Pond, Deer Lake (1404-0038)	Broome	Lake	B	Phosphorus	Onsite WTS	2010

Ramapo/Hackensack River Basin

NJ- 1/P977a-13-P984,P984a	Congers Lake, Sw artout Lake (1501-0019)	Rockland	Lake	B	Phosphorus	Urban/Storm Runoff	2010
NJ- 1/P977a-13-P985	Rockland Lake (1501-0021)	Rockland	Lake	B	Phosphorus	Urban/Storm Runoff	2012

⁸ A restoration strategy/TMDL for this segment will be developed in conjunction with the Schoharie Reservoir strategy/TMDL.

⁹ The specifically identified impaired water(s) in this segment include Kromma Kill (-234).

Total Maximum Daily Load (TMDL) for Phosphorus in Snyders Lake

Rensselaer County, New York

July 2009

Prepared for:

U.S. Environmental Protection Agency
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Prepared by:

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1.0 INTRODUCTION

1.1. Background

In April of 1991, the United States Environmental Protection Agency (EPA) Office of Water's Assessment and Protection Division published "Guidance for Water Quality-based Decisions: The Total Maximum Daily Load (TMDL) Process." In July 1992, EPA published the final "Water Quality Planning and Management Regulation" (40 CFR Part 130). Together, these documents describe the roles and responsibilities of EPA and the states in meeting the requirements of Section 303(d) of the Federal Clean Water Act (CWA) as amended by the Water Quality Act of 1987, Public Law 100-4. Section 303(d) of the CWA requires each state to identify those waters within its boundaries not meeting water quality standards for any given pollutant applicable to the water's designated uses.

Further, Section 303(d) requires EPA and states to develop TMDLs for all pollutants violating or causing violation of applicable water quality standards for each impaired waterbody. A TMDL determines the maximum amount of pollutant that a waterbody is capable of assimilating while continuing to meet the existing water quality standards. Such loads are established for all the point and nonpoint sources of pollution that cause the impairment at levels necessary to meet the applicable standards with consideration given to seasonal variations and margin of safety. TMDLs provide the framework that allows states to establish and implement pollution control and management plans with the ultimate goal indicated in Section 101(a)(2) of the CWA: "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water, wherever attainable" (USEPA, 1991).

1.2. Problem Statement

Snyders Lake (WI/PWL ID 1301-0043) is situated in the Town of North Greenbush, within Rensselaer County, New York. Over the past couple of decades, the lake has experienced degraded water quality that has reduced the lake's recreational and aesthetic value. Recreational assessments are usually described as either "excellent" or "slightly" impaired for most uses in Snyders Lake over the last several years. The lake is regularly described as "not quite crystal clear," a typical assessment for lakes with similar Secchi disk transparency readings. Aquatic plants regularly grow to the lake surface, but "excessive weed growth" has not impacted recreational assessments in recent years. However, the lake is subject to sporadic algal blooms caused by excessive nutrient loading. Snyders Lake was listed on the Lower Hudson River Basin PWL in 1999, with *bathing* listed as *impaired*, and *aquatic life, recreation, and aesthetics* listed as *stressed* due to excessive weed growth (NYS DEC, 2001).

Although a variety of sources of phosphorus are contributing to the poor water quality in Snyders Lake, it is primarily influenced by runoff events from the drainage basin. In response to precipitation, nutrients, such as phosphorus – naturally found in New York soils – drain into the lake from the surrounding drainage basin by way of streams, overland flow, and subsurface flow. Nutrients are then deposited and stored in the lake bottom sediments. Phosphorus is often the limiting nutrient in temperate lakes and ponds and can be thought of as a fertilizer; a primary food for plants, including algae. When lakes receive excess phosphorus, it "fertilizes" the lake by feeding the algae. Too much phosphorus can result in algae blooms, which can damage the ecology/aesthetics of a lake, as well as the economic well-being of the surrounding drainage basin community.

The results from state sampling efforts confirm eutrophic conditions in Snyders Lake, with the concentration of phosphorus in the lake exceeding the state guidance value for phosphorus (20 µg/L or 0.020 mg/L, applied as the mean summer, epilimnetic total phosphorus concentration), which increases the potential for nuisance summertime algae blooms. In 2002, Snyders Lake was added to the New York State Department of Environmental Conservation (NYS DEC) CWA Section 303(d) list of impaired waterbodies that do not meet water quality standards due to phosphorus impairments (NYS DEC, 2008). Based on this listing, a TMDL for phosphorus is being developed for the lake to address the impairment.

2.0 WATERSHED AND LAKE CHARACTERIZATION

2.1 Watershed Characterization

Snyders Lake has a direct drainage basin area of 732 acres excluding the surface area of the lake (Figure 1). Elevations in the lake's basin range from approximately 689 feet above mean sea level (AMSL) to as low as 488 feet AMSL at the surface of Snyders Lake.

Land use and land cover in the Snyders Lake drainage basin was determined from digital aerial photography and geographic information system (GIS) datasets. Digital land use/land cover data were obtained from the 2001 National Land Cover Dataset (Homer, 2004). The NLCD is a consistent representation of land cover for the conterminous United States generated from classified 30-meter resolution Landsat thematic mapper satellite imagery data. High-resolution color orthophotos and documents provided by Town of North Greenbush officials were used to manually update and refine land use categories for portions of the drainage basin to reflect current conditions in the drainage basin (Figure 2). Town of North Greenbush officials also provided documentation of approved developments. This additional development results in a conversion of 56 acres of forest and agricultural land to developed land; this conversion is reflected in the land use layer used for the modeling. Appendix A provides additional detail about the refinement of land use for the drainage basin. Updated land use categories (including individual category acres and percent of total) in Snyders Lake's drainage basin are listed in Table 1 and presented in Figures 3 and 4.

Figure 1. Snyders Lake Direct Drainage Basin

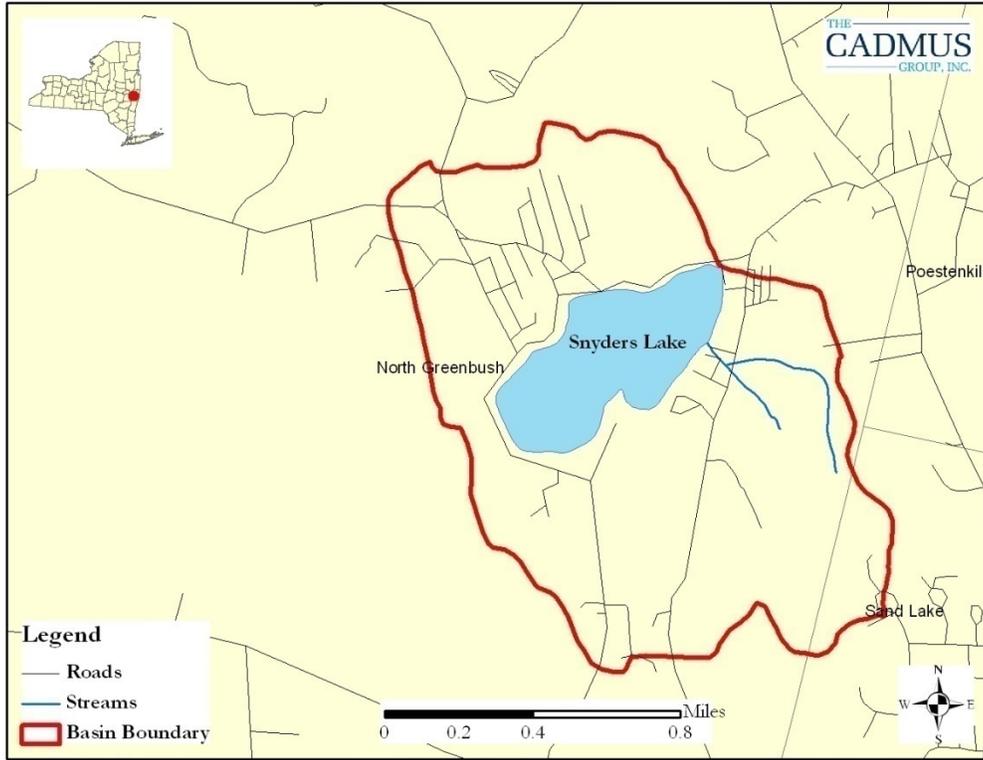


Figure 2. Aerial Image of Snyders Lake

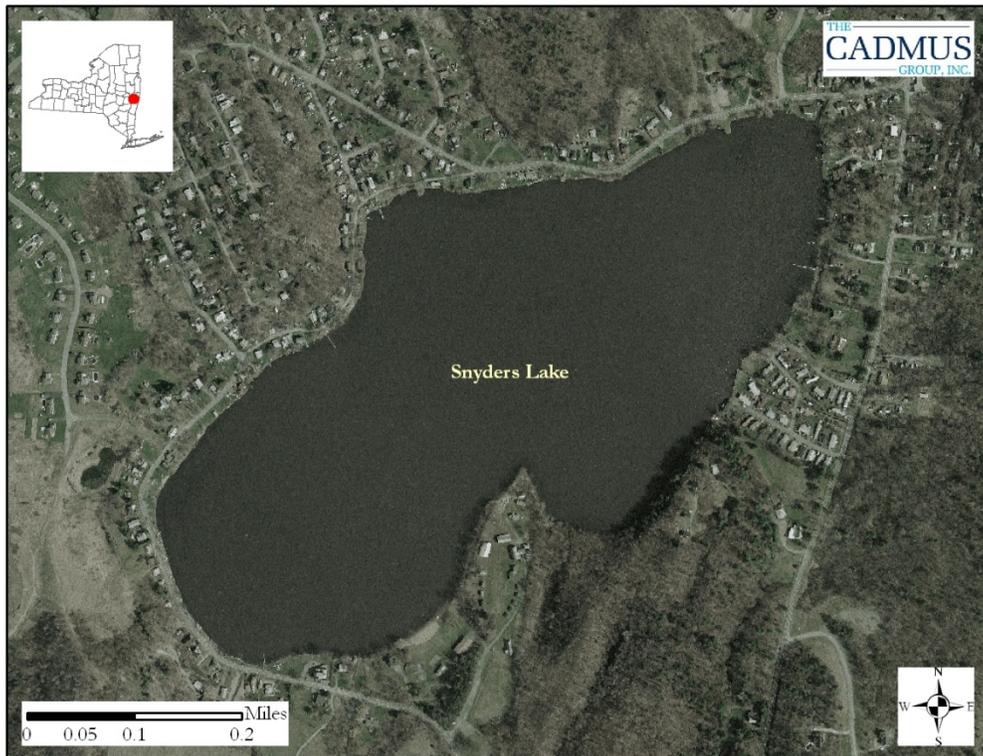


Table 1. Land Use Acres and Percent in Snyder's Lake Drainage Basin

Land Use Category	Acres	% of Drainage Basin
Open Water	3.6	0.5%
Agriculture	162.5	22.2%
<i>Hay & Pasture</i>	160.4	21.9%
<i>Cropland</i>	2.1	0.3%
Developed Land	250.3	34.2%
<i>Low Density Mixed</i>	62.5	8.5%
<i>High Density Mixed</i>	5.6	0.8%
<i>Low Density Residential</i>	84.80	11.6%
<i>Med. Density Residential</i>	97.4	13.3%
Forest	315.3	43.1%
Wetland	0.3	0.04%
TOTAL	732	100%

Approximately 80% of the drainage basin's land currently resides within an MS4

Figure 3. Percent Land Use in Snyder's Lake Drainage Basin

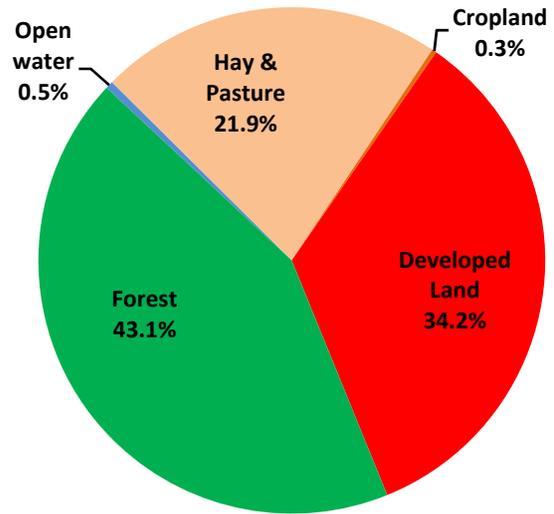
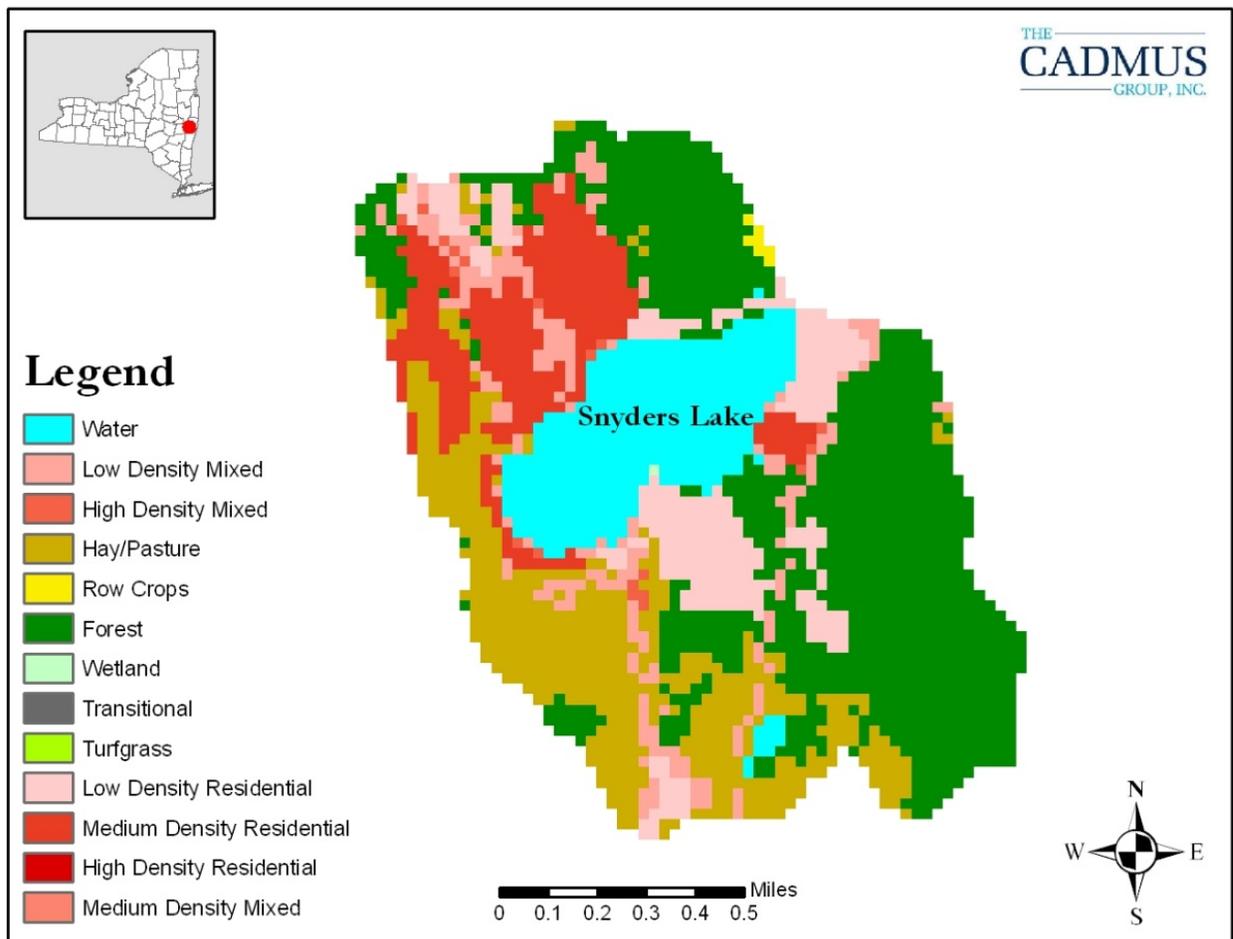


Figure 4. Land Use in Snyder's Lake Drainage Basin



2.2. Lake Morphometry

Snyders Lake is a 108 acre waterbody at an elevation of about 488 feet AMSL. Figure 5 shows a bathymetric map for Snyders Lake based on lake contour maps developed by NYS DEC. Table 2 summarizes key morphometric characteristics for Snyders Lake.

Figure 5. Bathymetric Map of Snyders Lake

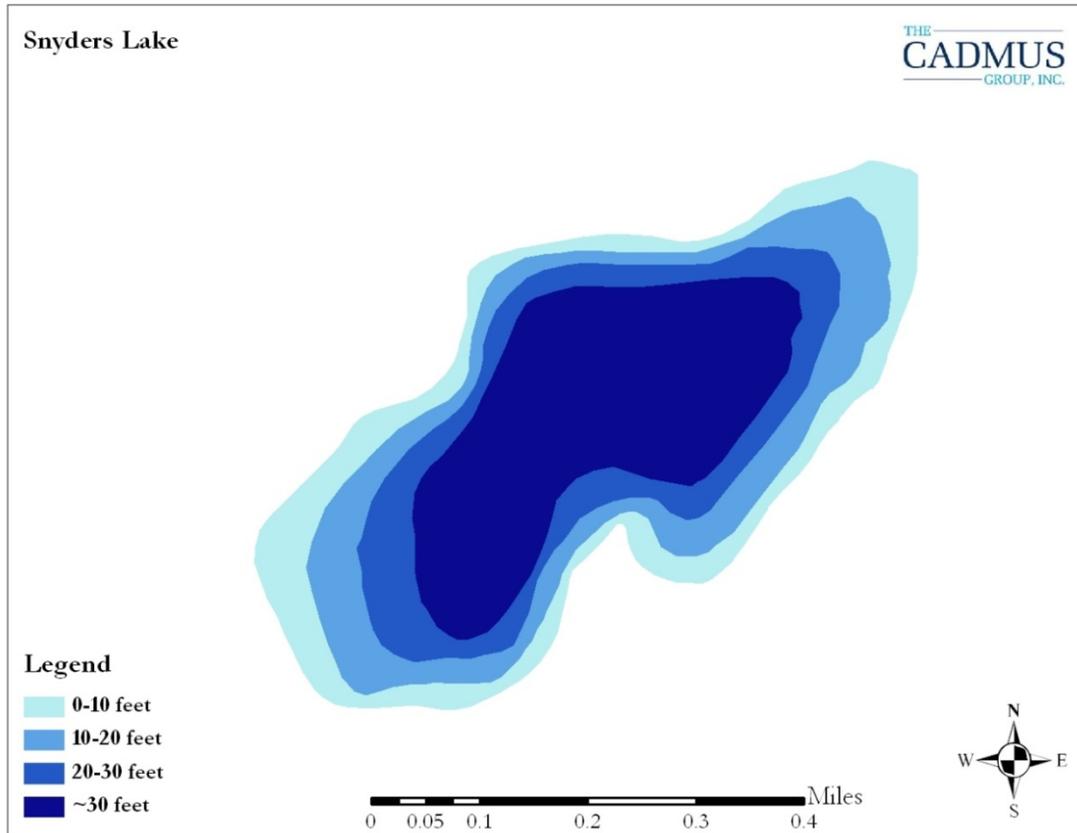


Table 2. Snyders Lake Characteristics

Surface Area (acres)	108
Elevation (ft AMSL)	488
Maximum Depth (ft)	30
Mean Depth (ft)	20
Length (ft)	3,879
Width at widest point (ft)	1,927
Shoreline perimeter (ft)	9,902
Direct Drainage Area (acres)	732
Watershed: Lake Ratio	7:1
Mass Residence Time (years)	0.5
Hydraulic Residence Time (years)	1.2

2.3. Water Quality

NYS DEC's Citizens Statewide Lake Assessment Program (CSLAP) is a cooperative volunteer monitoring effort between NYS DEC and the New York Federation of Lake Associations (FOLA). The goal of the program is to establish a volunteer lake monitoring program that provides data for a variety of purposes, including establishment of a long-term database for NYS lakes, identification of water quality problems on individual lakes, geographic and ecological groupings of lakes, and education for data collectors and users. The data collected in CSLAP are fully integrated into the state database for lakes, have been used to assist in local lake management and evaluation of trophic status, spread of invasive species, and other problems seen in the state's lakes.

Volunteers undergo on-site initial training and follow-up quality assurance and quality control sessions are conducted by NYS DEC and trained NYS FOLA staff. After training, equipment, supplies, and preserved bottles are provided to the volunteers by NYS DEC for bi-weekly sampling for a 15 week period between May and October. Water samples are analyzed for standard lake water quality indicators, with a focus on evaluating eutrophication status-total phosphorus, nitrogen (nitrate, ammonia, and total), chlorophyll *a*, pH, conductivity, color, and calcium. Field measurements include water depth, water temperature, and Secchi disk transparency. Volunteers also evaluate use impairments through the use of field observation forms, utilizing a methodology developed in Minnesota and Vermont. Aquatic vegetation samples, deepwater samples, and occasional tributary samples are also collected by sampling volunteers at some lakes. Data are sent from the laboratory to NYS DEC and annual interpretive summary reports are developed and provided to the participating lake associations and other interested parties.

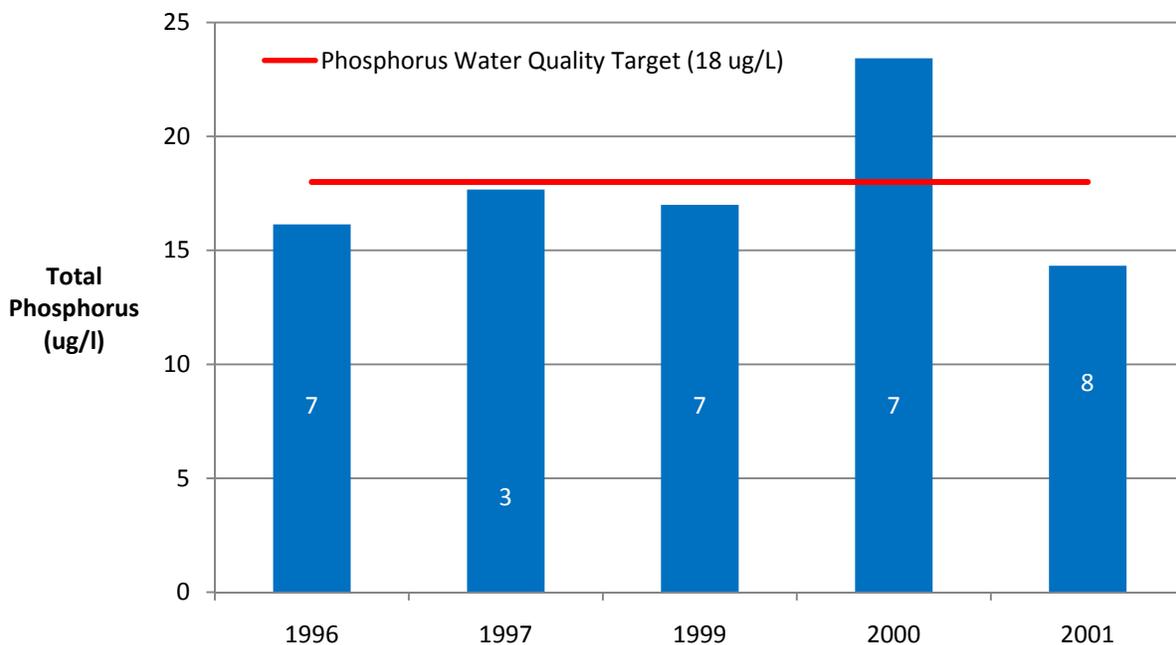
NYS DEC's Lake Classification and Inventory (LCI) program was initiated in 1982 and is conducted by NYS DEC staff. Each year, approximately 10-25 water bodies are sampled in a specific geographic region of the state. The waters selected for sampling are considered to be the most significant in that particular region, both in terms of water quality and level of public access. Samples are collected for pH, ANC, specific conductance, temperature, oxygen, chlorophyll *a*, nutrients and plankton at the surface and with depth at the deepest point of the lake, 4-7 times per year (with stratified lakes sampled more frequently than shallow lakes). Sampling generally begins during May and ends in October.

The LCI effort had been suspended after 1992, due to resource (mostly staff time) limitations, but was resumed again in 1996 on a smaller set of lakes. Since 1998, this program has been geographically linked with the Rotating Integrated Basin Sampling (RIBS) stream monitoring program conducted by the NYS DEC Bureau of Watershed Assessment. LCI sites are chosen within the RIBS monitoring basins (Susquehanna River basin in 1998, Long Island Sound/Atlantic Ocean and Lake Champlain basins in 1999, Genesee and Delaware River basins in 2000, and the Mohawk and Niagara Rivers basins in 2001, Upper Hudson River and Seneca/Oneida/Oswego Rivers basins in 2002, and the Lake Champlain, Lower Hudson River, and Atlantic Ocean/Long Island Sound basin in 2003) from among the waterbodies listed on the NYS Priority Waterbodies List for which water quality data are incomplete or absent, or from the largest lakes in the respective basin in which no water quality data exists within the NYS DEC database.

As part of CSLAP and LCI, a limited number of water quality samples were collected in Snyders Lake during the summers of 1996-2001. The results from these sampling efforts show eutrophic conditions in Snyders Lake, with the concentration of phosphorus in the lake exceeding the state

guidance value for phosphorus in 2000 and close to exceeding the guidance value in other years (20 µg/L or 0.02 mg/L, applied as the mean summer, epilimnetic total phosphorus concentration), which increases the potential for nuisance summertime algae blooms. Figure 6 shows the summer mean epilimnetic phosphorus concentrations for phosphorus data collected during all sampling seasons and years in which Snyders Lake was sampled as part of CSLAP; the number annotations on the bars indicate the number of data points included in each summer mean.

Figure 6. Summer Mean Epilimnetic Total Phosphorus Levels in Snyders Lake



3.0 NUMERIC WATER QUALITY TARGET

The TMDL target is a numeric endpoint specified to represent the level of acceptable water quality that is to be achieved by implementing the TMDL. The water quality classification for Snyders Lake is *B*, which means that the best usages of the lake are primary and secondary contact recreation and fishing. The lake must also be suitable for fish propagation and survival. New York State has a narrative standard for nutrients -- none in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages (6 NYSCRR Part 703.2). As part of its Technical and Operational Guidance Series (TOGS 1.1.1 and accompanying fact sheet, NYS, 1993), NYS DEC has suggested that for waters classified as ponded (i.e., lakes, reservoirs and ponds, excluding Lakes Erie, Ontario, and Champlain), the epilimnetic summer mean total phosphorus level shall not exceed 20 µg/L (or 0.02 mg/L), based on biweekly sampling, conducted from June 1 to September 30. Taking into account a margin of safety (MOS) of 10%, the TMDL target for Snyders Lake is a summer mean total phosphorus level not to exceed 18 µg/L, based on biweekly sampling, conducted from June 1 to September 30.

4.0 SOURCE ASSESSMENT

4.1. Analysis of Phosphorus Contributions

The MapShed watershed runoff model was used in combination with the BATHTUB lake response model to develop the Snyders Lake TMDL. This approach consists of using MapShed to determine mean annual phosphorus loading to the lake, and BATHTUB to define the extent to which this load must be reduced to meet the water quality target.

MapShed incorporates an enhanced version of the Generalized Watershed Loading Function (GWLF) model developed by Haith and Shoemaker (1987) and the RUNQUAL model also developed by Haith (1993). GWLF and RUNQUAL simulate runoff and stream flow by a water-balance method based on measurements of daily precipitation and average temperature. The complexity of the two models falls between that of detailed, process-based simulation models and simple export coefficient models that do not represent temporal variability. The GWLF and RUNQUAL models were determined to be appropriate for this TMDL analysis because they simulate the important processes of concern, but do not have onerous data requirements for calibration. MapShed was developed to facilitate the use of the GWLF and RUNQUAL models via a MapWindow interface (Evans, 2009). Appendix A discusses the setup, calibration, and use of the MapShed model for lake TMDL assessments in New York.

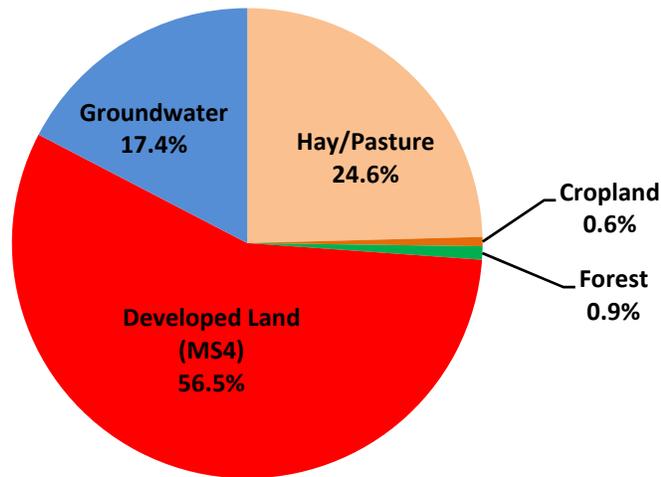
4.2. Sources of Phosphorus Loading

MapShed was used to estimate long-term (1990-2007) mean annual phosphorus (external) loading to Snyders Lake. The estimated mean annual external load of 187.3 lbs/yr of total phosphorus that enters Snyders Lake comes from the sources listed in Table 3 and shown in Figure 7. Appendix A provides the detailed simulation results from MapShed. Loading from residential septic tanks is not a concern in the basin, as all of the developed areas in the basin are served by sanitary sewer; discharge from the sanitary sewer is outside of the basin.

Table 3. Estimated Sources of Phosphorus Loading to Snyders Lake

Source	Total Phosphorus (lbs/yr)
Hay/Pasture	46.01
Cropland	1.17
Forest	1.74
Developed Land (MS4)	105.82
Groundwater	32.54
TOTAL	187.3

Figure 7. Estimated Sources of Total Phosphorus Loading to Snyders Lake



4.2.1. *Agricultural Runoff*

Agricultural land originally encompassed 201 acres (27.4%) of the lake drainage basin. As noted with new development, this area will decrease to 162.5 acres (22.2%) of the lake drainage basin. Based on this new development, overland runoff from agricultural land is estimated to contribute 47.2 lbs/yr of phosphorus loading to Snyders Lake, which is 25.2% of the total phosphorus loading to the lake.

Phosphorus loading from agricultural land originates primarily from soil erosion and the application of manure and fertilizers. Implementation plans for agricultural sources will require voluntary controls applied on an incremental basis. In addition to the contribution of phosphorus to the lake from overland agriculture runoff, additional phosphorus originating from agricultural lands is leached in dissolved form from the surface and transported to the lake through subsurface movement via groundwater. The process for estimating subsurface delivery of phosphorus originating from agricultural land is discussed in the Groundwater Seepage section (below).

4.2.2. *Urban and Residential Development Runoff*

Developed land originally comprised 186 acres (25%) of the lake drainage basin with approximately 83% of that developed land residing within a Municipal Separate Storm Sewer System (MS4); however, the MS4 permit coverage is going to be extended to cover loading from all of the developed areas in the basin. With new development the area of developed land increases to 250.2 acres (34.2% of the basin). Based on this new development, stormwater runoff from developed land is estimated to contribute 105.8 lbs/yr of phosphorus to Snyders Lake, which is about 56.5% of the total phosphorus loading to the lake. Since the MS4 permit coverage will be extended to cover loading from all of the developed areas in the basin, loading from all developed areas will be subject to regulation under the MS4 permit.

Phosphorus runoff from developed areas originates primarily from human activities, such as fertilizer applications to lawns. Shoreline development, in particular, can have a large phosphorus loading impact to nearby waterbodies in comparison to its relatively small percentage of the total land area in the drainage basin. In addition to the contribution of phosphorus to the lake from

overland urban runoff, additional phosphorus originating from developed lands is leached in dissolved form from the surface and transported to the lake through subsurface movement via groundwater. The process for estimating subsurface delivery of phosphorus originating from developed land is discussed in the Groundwater Seepage section (below).

4.2.3. *Forest Land Runoff*

Forested land originally comprised 342 acres of the lake drainage basin. With the new development, this decreases to 315 acres (43%) of the lake drainage basin. Based on new development, runoff from forested land is estimated to contribute 1.7 lbs/yr of phosphorus loading to Snyders Lake, which is about 0.9% of the total phosphorus loading to the lake. Phosphorus contribution from forested land is considered a component of background loading.

4.2.4. *Groundwater Seepage*

In addition to nonpoint sources of phosphorus delivered to the lake by surface runoff, a portion of the phosphorus loading from nonpoint sources seeps into the ground and is transported to the lake via groundwater. Groundwater is estimated to transport 32.5 lbs/yr (17.4%) of the total phosphorus load to Snyders Lake. With respect to groundwater, there is typically a small “background” concentration owing to various natural sources. In the Snyders Lake drainage basin, the model-estimated groundwater phosphorus concentration is 0.019 mg/L. The GWLF manual provides estimated background groundwater phosphorus concentrations for ≥90% forested land in the eastern United States, which is 0.006 mg/L. Consequently, about 31.58% of the groundwater load (10.276 lbs/yr) can be attributed to natural sources, including forested land and soils. The remaining amount of the groundwater phosphorus load likely originates from agricultural and developed land sources (i.e., leached in dissolved form from the surface). It is estimated that the remaining 22.264 lbs/yr of phosphorus transported to the lake through groundwater originates from developed land (15.399 lbs/yr) and agricultural sources (6.865 lbs/yr), proportional to their respective surface runoff loads. Table 4 summarizes this information.

Table 4. Sources of Phosphorus Transported in the Subsurface via Groundwater

	Total Phosphorus (lbs/yr)	% of Total Groundwater Load
Natural Sources	10.276	31.58%
Agricultural Land	6.865	21.10%
Developed Land	15.399	47.32%
TOTAL	32.540	100%

4.2.5. *Other Sources*

Atmospheric deposition, wildlife, waterfowl, and domestic pets are also potential sources of phosphorus loading to the lake. All of these small sources of phosphorus are incorporated into the land use loadings as identified in the TMDL analysis (and therefore accounted for). Further, the deposition of phosphorus from the atmosphere over the surface of the lake is accounted for in the lake model, though it is small in comparison to the external loading to the lake.

5.0 DETERMINATION OF LOAD CAPACITY

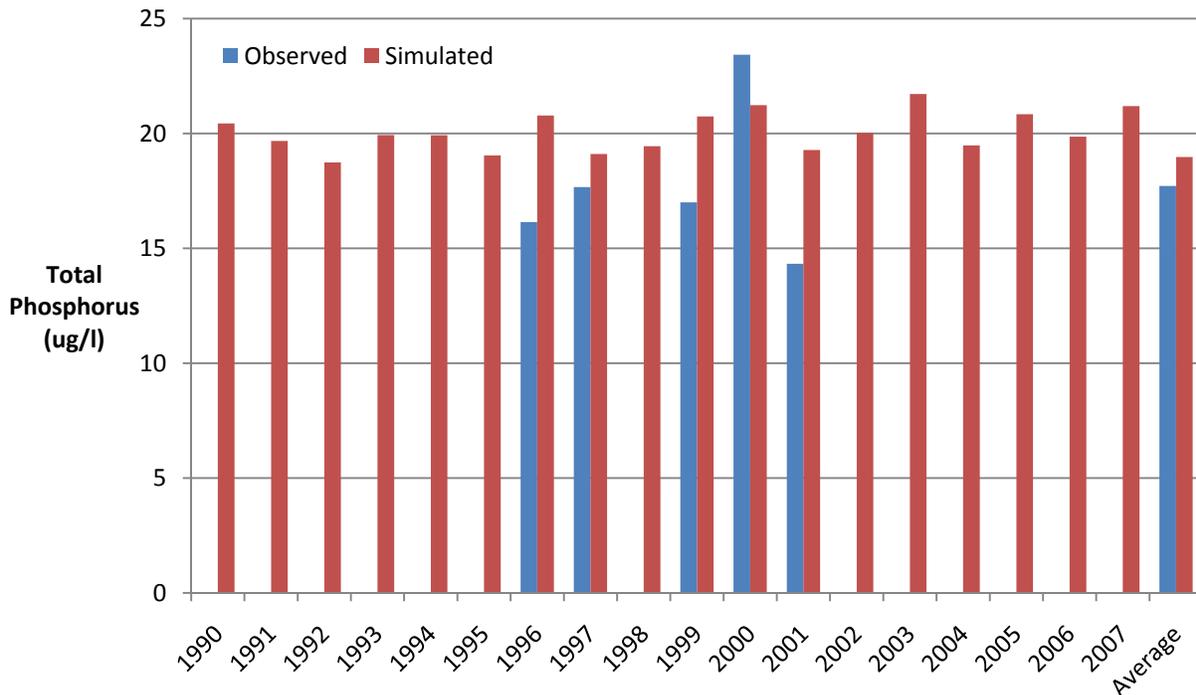
5.1. Lake Modeling Using the BATHTUB Model

BATHTUB was used to define the relationship between phosphorus loading to the lake and the resulting concentrations of total phosphorus in the lake. The U.S. Army Corps of Engineers' BATHTUB model predicts eutrophication-related water quality conditions (e.g., phosphorus, nitrogen, chlorophyll a, and transparency) using empirical relationships previously developed and tested for reservoir applications (Walker, 1987). BATHTUB performs steady-state water and nutrient balance calculations in a spatially segmented hydraulic network. Appendix B discusses the setup, calibration, and use of the BATHTUB model.

5.2. Linking Total Phosphorus Loading to the Numeric Water Quality Target

In order to estimate the loading capacity of the lake, simulated phosphorus loads from MapShed were used to drive the BATHTUB model to simulate water quality in Snyders Lake. MapShed was used to derive a mean annual phosphorus loading to the lake for the period 1990-2007. Using this load as input, BATHTUB was used to simulate water quality in the lake. The results of the BATHTUB simulation were compared against the average of the lake's observed summer mean phosphorus concentrations for the years 1996-2001 (excluding 1998). Year-specific loading was also simulated with MapShed, run through BATHTUB, and compared against the observed summer mean phosphorus concentration for years with observed in-lake data. The combined use of MapShed and BATHTUB provides a decent fit to the observed data for Snyders Lake (Figure 8).

Figure 8. Observed vs. Simulated Summer Mean Epilimnetic Total Phosphorus Concentrations ($\mu\text{g/L}$) in Snyders Lake



The BATHTUB model was used as a “diagnostic” tool to derive the total phosphorus load reduction required to achieve the phosphorus target of 18 µg/L. The loading capacity of Snyders Lake was determined by running BATHTUB iteratively, reducing the concentration of the drainage basin phosphorus load until model results demonstrated attainment of the water quality target. The maximum concentration that results in compliance with the TMDL target for phosphorus is used as the basis for determining the lake’s loading capacity. This concentration is converted into a loading rate using simulated flow from MapShed.

The maximum annual phosphorus load (i.e., the annual TMDL) that will maintain compliance with the phosphorus water quality goal of 18 µg/L in Snyders Lake is a mean annual load of 172.56 lbs/yr. The daily TMDL of 0.47 lbs/day was calculated by dividing the annual load by the number of days in a year. Lakes and reservoirs store phosphorus in the water column and sediment, therefore water quality responses are generally related to the total nutrient loading occurring over a year or season. For this reason, phosphorus TMDLs for lakes and reservoirs are generally calculated on an annual or seasonal basis. The use of annual loads, versus daily loads, is an accepted method for expressing nutrient loads in lakes and reservoirs. This is supported by EPA guidance such as *The Lake Restoration Guidance Manual* (USEPA 1990) and *Technical Guidance Manual for Performing Waste Load Allocations, Book IV, lakes and Impoundments, Chapter 2 Eutrophication* (USEPA 1986). While a daily load has been calculated, it is recommended that the annual loading target be used to guide implementation efforts since the annual load of total phosphorus as a TMDL target is more easily aligned with the design of best management practices (BMPs) used to implement nonpoint source and stormwater controls for lakes than daily loads. Ultimate compliance with water quality standards for the TMDL will be determined by measuring the lake’s water quality to determine when the phosphorus guidance value is attained.

6.0 POLLUTANT LOAD ALLOCATIONS

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources so that appropriate control measures can be implemented and water quality standards achieved. Individual waste load allocations (WLAs) are assigned to discharges regulated by State Pollutant Discharge Elimination System (SPDES) permits (commonly called point sources) and unregulated loads (commonly called nonpoint sources) are contained in load allocations (LAs). A TMDL is expressed as the sum of all individual WLAs for point source loads, LAs for nonpoint source loads, and an appropriate margin of safety (MOS), which takes into account uncertainty (Equation 1).

Equation 1. Calculation of the TMDL

$$TMDL = \sum WLA + \sum LA + MOS$$

6.1 Wasteload Allocation (WLA)

The WLA is set at 94.54 lbs/yr. There are no permitted wastewater treatment plant dischargers in the Snyders Lake basin; however, there are MS4s within the basin, which are subject to permits issued by NYS DEC and present the most direct opportunity for load reductions. Since much of the non-MS4 area has already been developed, NYS DEC will extend MS4 designation to the remainder of the watershed as explained in Section 7.1.1. Thus, the entire 105.8 lbs/yr of

phosphorus load in the stormwater runoff from developed land is subject to regulation under the MS4 permit.

The total required reduction of MS4 regulated stormwater is 11.29 lbs/yr, or an 11% reduction. Designation of the entire watershed as a regulated MS4 means that to maintain the WLA, post-construction loads from ongoing development will need to be offset by additional retrofits on stormwater from already developed lands beyond the 11% reduction. MapShed does not distinguish construction from other stormwater loads; therefore, the WLA for MS4s includes some undistinguished loads from future stormwater general permits for construction.

6.2. Load Allocation (LA)

The LA is set at 78.03 lbs/yr. Nonpoint sources that contribute total phosphorus to Snyders Lake on an annual basis include loads from developed and agricultural land. Table 5 lists the current loading for each source and the load allocation needed to meet the TMDL; Figure 9 provides a graphical representation of this information. Phosphorus originating from natural sources (including forested land, wetlands, and stream banks) is assumed to be a minor source of loading that is unlikely to be reduced further and therefore the load allocation is set at current loading.

6.3. Margin of Safety (MOS)

The margin of safety (MOS) can be incorporated into the TMDL analysis through conservative assumptions or expressed in the TMDL as a portion of the loadings, or a combination of both. For the Snyders Lake TMDL, the MOS is accounted for in the conservative TMDL target of 18 µg/L. New York State has a narrative standard for nutrients -- none in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages (6 NYSCRR Part 703.2). As part of its Technical and Operational Guidance Series (TOGS 1.1.1 and accompanying fact sheet, NYS, 1993), NYS DEC has suggested that for waters classified as ponded (i.e., lakes, reservoirs and ponds, excluding Lakes Erie, Ontario, and Champlain), the epilimnetic summer mean total phosphorus level shall not exceed 20 µg/L (or 0.02 mg/L), based on biweekly sampling, conducted from June 1 to September 30. The difference between the in-lake target of 18 µg/L and the 20 µg/L guidance value represents a 10% MOS for Snyders Lake. The MOS can be reviewed in the future as new data become available.

6.4. Critical Conditions

TMDLs must take into account critical environmental conditions to ensure that the water quality is protected during times when it is most vulnerable. Critical conditions were taken into account in the development of this TMDL. In terms of loading, spring runoff periods are considered critical because wet weather events transport significant quantities of nonpoint source loads to lakes. However, the water quality ramifications of these nutrient loads are most severe during middle or late summer. Therefore, BATHTUB model simulations were compared against observed data for the summer period only. Furthermore, MapShed takes into account loadings from all periods throughout the year, including spring loads.

6.5. Seasonal Variations

Seasonal variation in nutrient load and response is captured within the models used for this TMDL. In BATHHTUB, seasonality is incorporated in terms of seasonal averages for summer. Seasonal variation is also represented in the TMDL by taking 18 years of daily precipitation data when calculating runoff through MapShed. This takes into account the seasonal effects the lake will undergo during a given year.

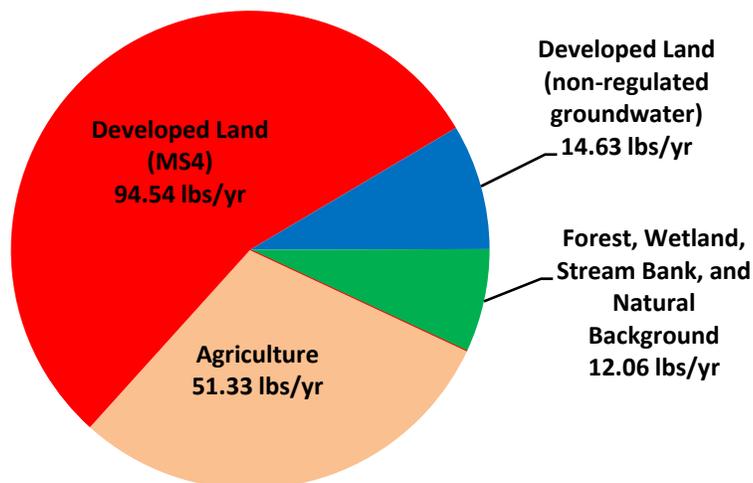
Table 5. Total Annual Phosphorus Load Allocations for Snyders Lake*

Source	Total Phosphorus Load (lbs/yr)			% Reduction
	Current	Allocated	Reduction	
Agriculture**	54.04	51.33	2.71	5%
Developed Land (non-regulated groundwater)	15.40	14.63	0.77	5%
Forest, Wetland, Stream Bank, and Natural Background**	12.06	12.06	0	0%
LOAD ALLOCATION	81.50	78.02	3.48	4%
Developed Land (regulated MS4 stormwater)	105.82	94.54	11.28	11%
WASTELOAD ALLOCATION	105.82	94.54	11.28	11%
LA + WLA	187.32	172.56	14.76	8%
Margin of Safety	MOS of 10% built into the TMDL endpoint			
TOTAL	187.32	172.56	---	---

* The values reported in Table 5 are annually integrated. Daily equivalent values are provided in Appendix C.

** Includes phosphorus transported through surface runoff and subsurface (groundwater)

Figure 9. Total Phosphorus Load Allocations for Snyders Lake (lbs/yr)



7.0 IMPLEMENTATION

One of the critical factors in the successful development and implementation of TMDLs is the identification of potential management alternatives, such as best management practices (BMPs) and screening and selection of final alternatives in collaboration with the involved stakeholders. Coordination with federal agencies, state agencies, local governments, and stakeholders such as the Snyders Lake Association, the general public, environmental interest groups, and representatives from the nonpoint pollution sources will ensure that the proposed management alternatives are technically and financially feasible. NYS DEC, in coordination with these local interests, will address the sources of impairment using regulatory and non-regulatory tools by matching management strategies with funding and available resources to effect implementation.

NYS DEC recognizes that TMDL designated load reductions alone may not be sufficient to restore eutrophic lakes. The TMDL establishes the required nutrient reduction targets and provides some regulatory framework to effect those reductions. However, the nutrient load only affects the eutrophication potential of a lake. The implementation plan therefore calls for the collection of additional monitoring data as discussed in Section 7.2. Monitoring is crucial to ensure that corrective measures implemented to achieve the TMDL pollutant allocations are effective and to compile data to inform future adjustments to TMDL implementation activities.

7.1. Reasonable Assurance for Implementation

Reasonable assurance that this TMDL will be implemented is provided by linking MS4 permit requirements to the wasteload allocation for permitted stormwater discharges (regulated MS4s in Table 5) and by showing how existing nonpoint source control programs could address sources of phosphorus that are not covered by a SPDES permit to achieve the load allocation.

Because stormwater runoff from MS4s is regulated by a SPDES permit, significant reductions can be effected by permit conditions that implement the WLA. Although much of this reduction can be achieved through public education, particularly by promoting reductions in fertilizer use or substitution of phosphorus-free fertilizer, retrofits to existing stormwater facilities could be required.

7.1.1. *Recommended Phosphorus Management Strategies for Regulated MS4 Stormwater Runoff*

NYS DEC has expanded its permitting program to include a federally mandated program to control stormwater runoff and protect waterways. According to the federal law and implementing regulations, commonly known as Stormwater Phase II, permits are required for stormwater discharges from MS4s in urbanized areas and for construction activities disturbing one or more acres. To implement the law, the NYS DEC has developed two general SPDES permits, one for MS4s in urbanized areas and one for construction activities. Operators of regulated small MS4s seeking authorization to discharge stormwater in compliance with the Federal CWA are required to apply for and secure coverage under the SPDES General Permit for MS4s. Operators of regulated MS4s and construction activities must obtain either a SPDES or a general permit no later than March 10, 2003 or prior to the commencement of construction. MS4 municipalities are required to develop, implement and enforce a stormwater management program (SWMP). The SWMP must describe the BMPs for each of the minimum control measures:

1. Public education and outreach program to inform the public about the impacts of the stormwater on the receiving water quality.
2. Public involvement and participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control program for sites disturbing one or more acres.
5. Post-construction runoff control program for new development and redevelopment sites disturbing one or more acres.
6. Pollution prevention and good housekeeping operation and maintenance program.

Operators must have developed the initial SWMP prior to March 10, 2003 and have provided adequate resources to fully implement the SWMP no later than five years from the issuance date of the MS4 permit. The MS4s that discharge to the Snyders Lake Watershed are owned and operated by the municipalities located around this waterbody. Accordingly, all municipalities identified in the TMDL have submitted an application to gain coverage under New York’s SPDES General Permit for Municipal Separate Storm Sewer Systems.

Each of the regulated MS4s in this TMDL (see table below) has developed an initial SWMP and has coverage under the general permit (initially GP-02-02, now GP- 0-08-002). An MS4 may modify its SWMP at any time, although any changes to a SWMP shall be reported to the NYSDEC in the MS4’s annual report. MS4s are required to make steady progress toward full implementation.

Permittee	SPDES #	Date Notice of Intent (NOI) Submitted
Town of North Greenbush	NYR20A191	3/7/2009
Rensselaer County	NYR20A392	3/18/2002

A SWMP is designed to reduce the discharge of pollutants to the maximum extent practicable (MEP) to protect water quality and to satisfy the appropriate water quality requirements of the Environmental Conservation Law and the CWA. MEP is a technology-based standard established by Congress in the CWA. No precise definition of MEP exists, therefore it allows for maximum flexibility on the part of MS4 operators as they develop their programs. Since stormwater is discharged to a 303(d)-listed segment of a waterbody, the SWMP must ensure there is no resulting increase in the pollutant of concern – phosphorus - to the receiving waters.

Since the WLA in this TMDL requires phosphorus load reductions to meet water quality standards, NYS DEC enforces additional requirements through the MS4 permit. The MS4s must review the applicable TMDL, and because the MS4s are not meeting the TMDL stormwater allocations, they must, within 180 days of written notification from the Department, modify their SWMP to ensure that reduction of the pollutant of concern specified in the TMDL – in this case a phosphorus reduction of 11% – is achieved. Modifications must be considered for each of the six minimum measures. The revised management program must include an updated schedule for implementation.

Within three years of having modified its SWMP to ensure that reduction of phosphorus specified in the TMDL is achieved, the MS4s must assess their progress and evaluate their SWMP to determine the MS4’s effectiveness in reducing their discharges of phosphorus to TMDL waterbodies. This assessment shall be conducted for the portions of the MS4 storm sewershed that are within the

TMDL watershed. The assessment shall be done using department supported modeling of pollutant loading from the storm sewershed. Any stormwater controls that are included with future developments can be assessed for their effectiveness in reducing the phosphorus load increase associated with the land conversion.

Currently, only portions of the Town of North Greenbush are designated as an MS4 Urban Area. In order to implement the load reductions required by this TMDL, and to protect against further degradation of water quality, under Designation Criteria 1, in GP- 0-08-002, the entire Snyders Lake Watershed would be designated as regulated MS4s upon approval of this TMDL by EPA.

When the MS4 GP- 0-08-002 is renewed in 2010, it will likely extend watershed improvement strategy requirements for phosphorus to permittees in the Snyders Lake Watershed. Most notably there could be requirements for Post-Construction Stormwater Management, including a requirement to develop and commence implementation of a retrofit program.

The SPDES General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-0-08-001 became effective May 1, 2008. Because Snyders Lake is included in Appendix E of the permit, List of 303(d) segments impaired by pollutants related to construction activity (e.g., silt, sediment or nutrients), additional requirements to prepare a Stormwater Pollution Prevention Plan for certain construction activities are in effect.

This TMDL will likely invoke additional requirements for post-construction stormwater management practices designed in conformance with the Enhanced Phosphorus Removal Standards set forth in the SPDES General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-0-08-001, when the permit is renewed in 2010.

7.1.2. Recommended Phosphorus Management Strategies for Non-Regulated MS4 Groundwater

The watershed model accounts for phosphorus transported to the lake via groundwater originating from developed land. Since this load is not delivered to the lake by way of a constructed conveyance it is not regulated under the MS4 program. However, non-structural BMPs for MS4s can also be effective at reducing loading from groundwater. Implementing BMPs such as using fertilizers that contain low or zero phosphorus, cleaning up pet waste and public education can achieve the modest phosphorus load reduction of 0.77 lbs per year set forth in the TMDL.

7.1.3 Recommended Phosphorus Management Strategies for Agricultural Runoff

The TMDL calls for a phosphorus load reduction of 2.71 lbs per year generated from agricultural activities in the watershed. The Rensselaer County Soil and Water District should continue to work with these farming operations to assure good management. Much of this reduction is likely to happen as less land is being farmed. If erosion control practices or other capital improvement projects are necessary, cost sharing could be obtained under the New York State Soil and Water Conservation Committee (SWCC) Agricultural Non-point Source Abatement and Control Grants Program. Details of the program can be found at the SWCC website: <http://www.nys-soilandwater.org/aem/index.html>.

7.1.4. *Additional Protection Measures*

Measures to further protect water quality and limit the growth of phosphorus load that would otherwise offset load reduction efforts should be considered. The basic protections afforded by local zoning ordinances could be enhanced to limit non-compatible development, preserve natural vegetation along shorelines and tributaries and promote smart growth. Identification of wildlife habitats, sensitive environmental areas, and key open spaces within the watershed could lead to their preservation or protection by way of conservation easements or other voluntary controls.

7.2. Follow-up Monitoring

A targeted post-assessment monitoring effort will be initiated to determine the effectiveness of the implementation plan associated with the TMDL. Snyders Lake will be sampled in 2010 at its deepest location during the warmer part of the year (May through September) on 8 sampling dates. Grab samples will be collected at a depth of 1.5 meters and in the hypolimnion. The samples will be analyzed for the phosphorus series (total phosphorus, total soluble phosphorus, and soluble reactive phosphorus), the nitrogen series (nitrate, ammonia and total nitrogen), and chloride. The epilimnetic samples will be analyzed for chlorophyll a and the Secchi disk depth will be measured. A simple macrophyte survey will also be conducted one time during mid summer.

Depending on the speed and extent of implementation, the sampling will be repeated at a regular interval. The initial plan will be to set the interval at 5 years. In addition, as the information on the NYS DEC GIS system is updated (e.g., land use, BMPs, etc.), these updates will be applied to the input data for the BATHTUB and MapShed models. The information will be incorporated into the NYS DEC 305(b) report as needed.

8.0 PUBLIC PARTICIPATION

NYSDEC met with local representatives from the Town of North Greenbush, Snyders Lake Association and Rensselaer County Planning on June 12, 2009 to discuss TMDL fundamentals and development. Local input on the draft TMDL land use and phosphorus loadings was used to refine the data. Notice of availability of the Draft TMDL was made to local government representatives and interested parties. This Draft TMDL was public noticed in the Environmental Notice Bulletin on July 15, 2009. A 30-day public review period was established for soliciting written comments from stakeholders prior to the finalization and submission of the TMDL for EPA approval.

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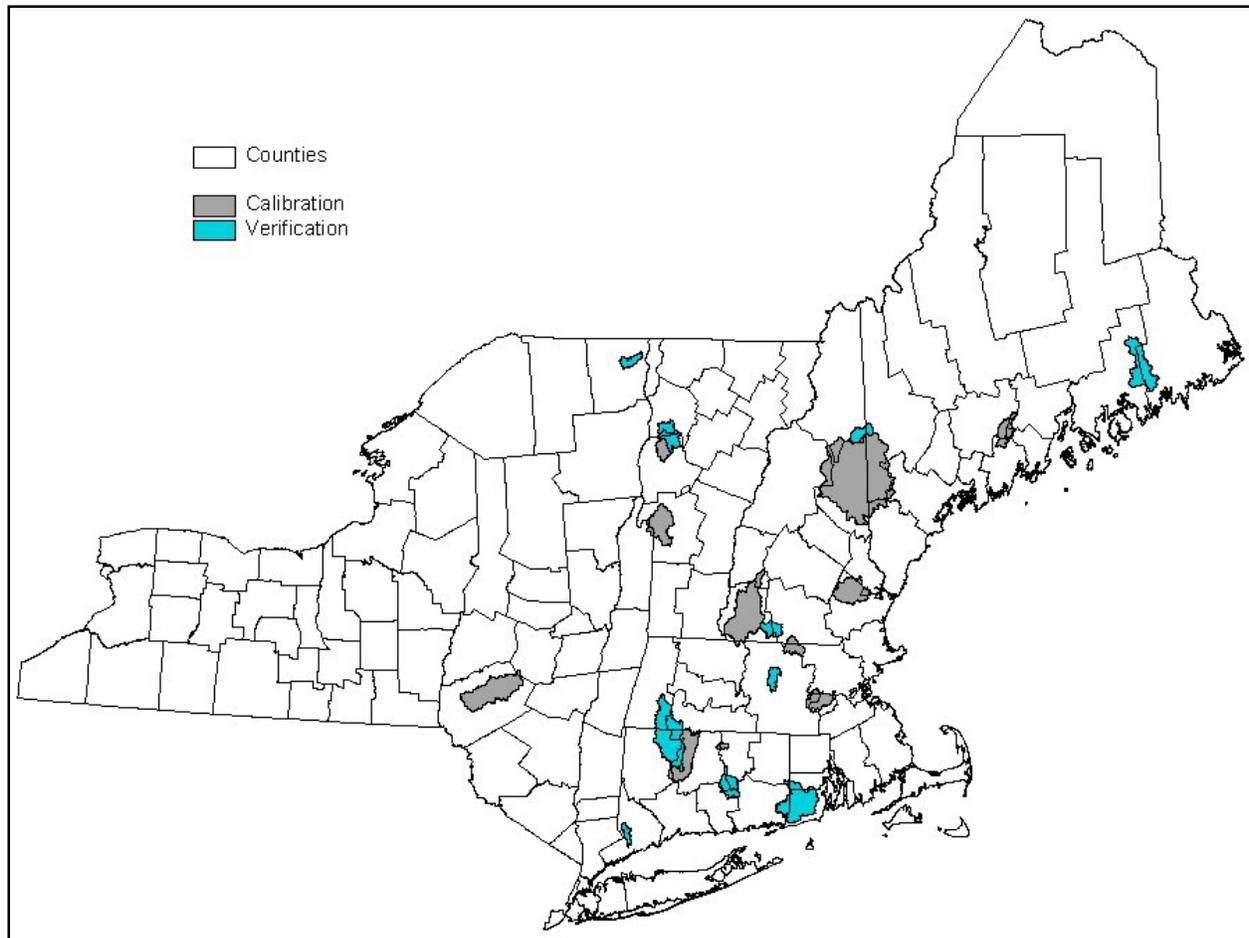
APPENDIX A. MAPSHED MODELING ANALYSIS

The MapShed model was developed in response to the need for a version of AVGWLF that would operate in a non-proprietary GIS package. AVGWLF had previously been calibrated for the Northeastern U.S. in general and New York specifically. Conversion of the calibrated AVGWLF to MapShed involved the transfer of updated model coefficients and a series of verification model runs. The calibration and conversion of the models is discussed in detail in this section.

Northeast AVGWLF Model

The AVGWLF model was calibrated and validated for the northeast (Evans et al., 2007). AVGWLF requires that calibration watersheds have long-term flow and water quality data. For the northeast model, watershed simulations were performed for twenty-two (22) watersheds throughout New York and New England for the period 1997-2004 (Figure 10). Flow data were obtained directly from the water resource database maintained by the U.S. Geological Survey (USGS). Water quality data were obtained from the New York and New England State agencies. These data sets included in-stream concentrations of nitrogen, phosphorus, and sediment based on periodic sampling.

Figure 10. Location of Calibration and Verification Watersheds for the Original Northeast AVGWLF Model



Initial model calibration was performed on half of the 22 watersheds for the period 1997-2004. During this step, adjustments were iteratively made in various model parameters until a “best fit” was achieved between simulated and observed stream flow, and sediment and nutrient loads. Based on the calibration results, revisions were made in various AVGWLF routines to alter the manner in which model input parameters were estimated. To check the reliability of these revised routines, follow-up verification runs were made on the remaining eleven watersheds for the same time period. Finally, statistical evaluations of the accuracy of flow and load predictions were made.

To derive historical nutrient loads, standard mass balance techniques were used. First, the in-stream nutrient concentration data and corresponding flow rate data were used to develop load (mass) versus flow relationships for each watershed for the period in which historical water quality data were obtained. Using the daily stream flow data obtained from USGS, daily nutrient loads for the 1997-2004 time period were subsequently computed for each watershed using the appropriate load versus flow relationship (i.e., “rating curves”). Loads computed in this fashion were used as the “observed” loads against which model-simulated loads were compared.

During this process, adjustments were made to various model input parameters for the purpose of obtaining a “best fit” between the observed and simulated data. With respect to stream flow, adjustments were made that increased or decreased the amount of the calculated evapotranspiration and/or “lag time” (i.e., groundwater recession rate) for sub-surface flow. With respect to nutrient loads, changes were made to the estimates for sub-surface nitrogen and phosphorus concentrations. In regard to both sediment and nutrients, adjustments were made to the estimate for the “C” factor for cropland in the USLE equation, as well as to the sediment “a” factor used to calculate sediment loss due to stream bank erosion. Finally, revisions were also made to the default retention coefficients used by AVGWLF for estimating sediment and nutrient retention in lakes and wetlands.

Based upon an evaluation of the changes made to the input files for each of the calibration watersheds, revisions were made to routines within AVGWLF to modify the way in which selected model parameters were automatically estimated. The AVGWLF software application was originally developed for use in Pennsylvania, and based on the calibration results, it appeared that certain routines were calculating values for some model parameters that were either too high or too low. Consequently, it was necessary to make modifications to various algorithms in AVGWLF to better reflect conditions in the Northeast. A summary of the algorithm changes made to AVGWLF is provided below.

- **ET:** A revision was made to increase the amount of evapotranspiration calculated automatically by AVGWLF by a factor of 1.54 (in the “Pennsylvania” version of AVGWLF, the adjustment factor used is 1.16). This has the effect of decreasing simulated stream flow.
- **GWR:** The default value for the groundwater recession rate was changed from 0.1 (as used in Pennsylvania) to 0.03. This has the effect of “flattening” the hydrograph within a given area.
- **GWN:** The algorithm used to estimate “groundwater” (sub-surface) nitrogen concentration was changed to calculate a lower value than provided by the “Pennsylvania” version.
- **Sediment “a” Factor:** The current algorithm was changed to reduce estimated stream bank-derived sediment by a factor of 90%. The streambank routine in AVGWLF was originally developed using Pennsylvania data and was consistently producing sediment estimates that were too high based on the in-stream sample data for the calibration sites in the Northeast. While the exact reason for this is not known, it’s likely that the glaciated terrain in the Northeast is less

erodible than the highly erodible soils in Pennsylvania. Also, it is likely that the relative abundance of lakes, ponds and wetlands in the Northeast have an effect on flow velocities and sediment transport.

- **Lake/Wetland Retention Coefficients:** The default retention coefficients for sediment, nitrogen and phosphorus are set to 0.90, 0.12 and 0.25, respectively, and changed at the user's discretion.

To assess the correlation between observed and predicted values, two different statistical measures were utilized: 1) the Pearson product-moment correlation (R^2) coefficient and 2) the Nash-Sutcliffe coefficient. The R^2 value is a measure of the degree of linear association between two variables, and represents the amount of variability that is explained by another variable (in this case, the model-simulated values). Depending on the strength of the linear relationship, the R^2 can vary from 0 to 1, with 1 indicating a perfect fit between observed and predicted values. Like the R^2 measure, the Nash-Sutcliffe coefficient is an indicator of "goodness of fit," and has been recommended by the American Society of Civil Engineers for use in hydrological studies (ASCE, 1993). With this coefficient, values equal to 1 indicate a perfect fit between observed and predicted data, and values equal to 0 indicate that the model is predicting no better than using the average of the observed data. Therefore, any positive value above 0 suggests that the model has some utility, with higher values indicating better model performance. In practice, this coefficient tends to be lower than R^2 for the same data being evaluated.

Adjustments were made to the various input parameters for the purpose of obtaining a "best fit" between the observed and simulated data. One of the challenges in calibrating a model is to optimize the results across all model outputs (in the case of AVGWLF, stream flows, as well as sediment, nitrogen, and phosphorus loads). As with any watershed model like GWLF, it is possible to focus on a single output measure (e.g., sediment or nitrogen) in order to improve the fit between observed and simulated loads. Isolating on one model output, however, can sometimes lead to less acceptable results for other measures. Consequently, it is sometimes difficult to achieve very high correlations (e.g., R^2 above 0.90) across all model outputs. Given this limitation, it was felt that very good results were obtained for the calibration sites. In model calibration, initial emphasis is usually placed on getting the hydrology correct. Therefore, adjustments to flow-related model parameters are usually finalized prior to making adjustments to parameters specific to sediment and nutrient production. This typically results in better statistical fits between stream flows than the other model outputs.

For the monthly comparisons, mean R^2 values of 0.80, 0.48, 0.74, and 0.60 were obtained for the calibration watersheds for flow, sediment, nitrogen and phosphorus, respectively. When considering the inherent difficulty in achieving optimal results across all measures as discussed above (along with the potential sources of error), these results are quite good. The sediment load predictions were less satisfactory than those for the other outputs, and this is not entirely unexpected given that this constituent is usually more difficult to simulate than nitrogen or phosphorus. An improvement in sediment prediction could have been achieved by isolating on this particular output during the calibration process; but this would have resulted in poorer performance in estimating the nutrient loads for some of the watersheds. Phosphorus predictions were less accurate than those for nitrogen. This is not unusual given that a significant portion of the phosphorus load for a watershed is highly related to sediment transport processes. Nitrogen, on the other hand, is often linearly correlated to flow, which typically results in accurate predictions of nitrogen loads if stream flows are being accurately simulated.

As expected, the monthly Nash-Sutcliffe coefficients were somewhat lower due to the nature of this particular statistic. As described earlier, this statistic is used to iteratively compare simulated values

against the mean of the observed values, and values above zero indicate that the model predictions are better than just using the mean of the observed data. In other words, any value above zero would indicate that the model has some utility beyond using the mean of historical data in estimating the flows or loads for any particular time period. As with R^2 values, higher Nash-Sutcliffe values reflect higher degrees of correlation than lower ones.

Improvements in model accuracy for the calibration sites were typically obtained when comparisons were made on a seasonal basis. This was expected since short-term variations in model output can oftentimes be reduced by accumulating the results over longer time periods. In particular, month-to-month discrepancies due to precipitation events that occur at the end of a month are often resolved by aggregating output in this manner (the same is usually true when going from daily output to weekly or monthly output). Similarly, further improvements were noted when comparisons were made on a mean annual basis. What these particular results imply is that AVGWLF, when calibrated, can provide very good estimates of mean annual sediment and nutrient loads.

Following the completion of the northeast AVGWLF model, there were a number of ideas on ways to improve model accuracy. One of the ideas relates to the basic assumption upon which the work undertaken in that project was based. This assumption is that a “regionalized” model can be developed that works equally well (without the need for resource-intensive calibration) across all watersheds within a large region in terms of producing reasonable estimates of sediment and nutrient loads for different time periods. Similar regional model calibrations were previously accomplished in earlier efforts undertaken in Pennsylvania (Evans et al., 2002) and later in southern Ontario (Watts et al., 2005). In both cases this task was fairly daunting given the size of the areas involved. In the northeast effort, this task was even more challenging given the fact that the geographic area covered by the northeast is about three times the size of Pennsylvania, and arguably is more diverse in terms of its physiographic and ecological composition.

As discussed, AVGWLF performed very well when calibrated for numerous watersheds throughout the region. The regionalized version of AVGWLF, however, performed less well for the verification watersheds for which additional adjustments were not made subsequent to the initial model runs. This decline in model performance may be a result of the regionally-adapted model algorithms not being rigorous enough to simulate spatially-varying landscape processes across such a vast geographic region at a consistently high degree of accuracy. It is likely that un-calibrated model performance can be enhanced by adapting the algorithms to reflect processes in smaller geographic regions such as those depicted in the physiographic province map in Figure 11.

Fine-tuning & Re-Calibrating the Northeast AVGWLF for New York State

For the TMDL development work undertaken in New York, the original northeast AVGWLF model was further refined by The Cadmus Group, Inc. and Dr. Barry Evans to reflect the physiographic regions that exist in New York. Using data from some of the original northeast model calibration and verification sites, as well as data for additional calibration sites in New York, three new versions of AVGWLF were created for use in developing TMDLs in New York State. Information on the fourteen (14) sites is summarized in Table 6. Two models were developed based on the following two physiographic regions: Eastern Great Lakes/Hudson Lowlands area and the Northeastern Highlands area. The model was calibrated for each of these regions to better reflect local conditions, as well as ecological and hydrologic processes. In addition to developing the above mentioned physiographic-based model calibrations, a third model calibration was also developed. This model

calibration represents a composite of the two physiographic regions and is suitable for use in other areas of upstate New York.

Figure 11. Location of Physiographic Provinces in New York and New England

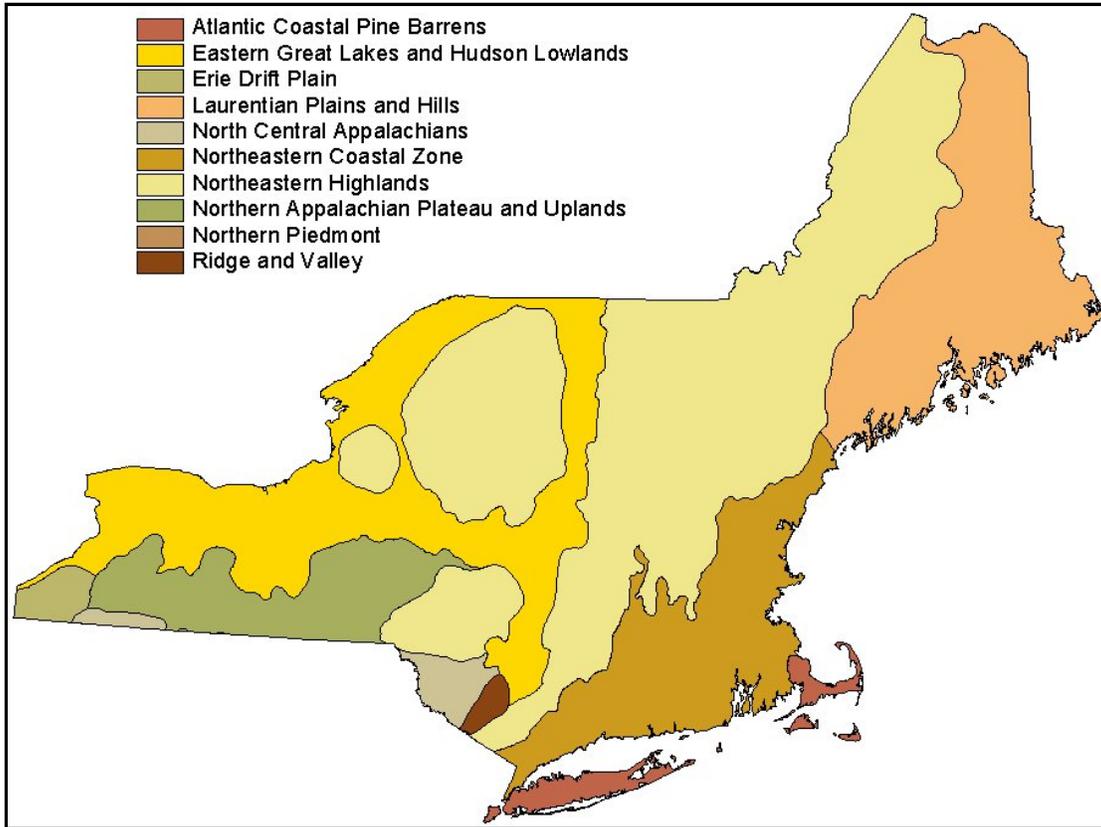


Table 6. AVGWLFW Calibration Sites for use in the New York TMDL Assessments

Site	Location	Physiographic Region
Owasco Lake	NY	Eastern Great Lakes/Hudson Lowlands
West Branch	NY	Northeastern Highlands
Little Chazy River	NY	Eastern Great Lakes/Hudson Lowlands
Little Otter Creek	VT	Eastern Great Lakes/Hudson Lowlands
Poultney River	VT/NY	Eastern Great Lakes/Hudson Lowlands & Northeastern Highlands
Farmington River	CT	Northeastern Highlands
Saco River	ME/NH	Northeastern Highlands
Squannacook River	MA	Northeastern Highlands
Ashuelot River	NH	Northeastern Highlands
Laplatte River	VT	Eastern Great Lakes/Hudson Lowlands
Wild River	ME	Northeastern Highlands
Salmon River	CT	Northeastern Coastal Zone
Norwalk River	CT	Northeastern Coastal Zone
Lewis Creek	VT	Eastern Great Lakes/Hudson Lowlands

Conversion of the AVGWLF Model to MapShed and Inclusion of RUNQUAL

The AVGWLF model requires that users obtain ESRI's ArcView 3.x with Spatial Analyst. The Cadmus Group, Inc. and Dr. Barry Evans converted the New York-calibrated AVGWLF model for use in a non-proprietary GIS package called MapWindow. The converted model is called MapShed and the software necessary to use it can be obtained free of charge and operated by any individual or organization who wishes to learn to use it. In addition to incorporating the enhanced GWLF model, MapShed contains a revised version of the RUNQUAL model, allowing for more accurate simulation of nutrient and sediment loading from urban areas.

RUNQUAL was originally developed by Douglas Haith (1993) to refine the urban runoff component of GWLF. Using six urban land use classes, RUNQUAL differentiates between three levels of imperviousness for residential and mixed commercial uses. Runoff is calculated for each of the six urban land uses using a simple water-balance method based on daily precipitation, temperature, and evapotranspiration. Pollutant loading from each land use is calculated with exponential accumulation and washoff relationships that were developed from empirical data. Pollutants, such as phosphorus, accumulate on surfaces at a certain rate (kg/ha/day) during dry periods. When it rains, the accumulated pollutants are washed off of the surface and have been measured to develop the relationship between accumulation and washoff. The pervious and impervious portions of each land use are modeled separately and runoff and contaminant loads are added to provide total daily loads. RUNQUAL is also capable of simulating the effects of various urban best management practices (BMPs) such as street sweeping, detention ponds, infiltration trenches, and vegetated buffer strips.

Set-up of the “New York State” MapShed Model

Using data for the time period 1990-2007, the calibrated MapShed model was used to estimate mean annual phosphorus loading to the lake. Table 7 provides the sources of data used for the MapShed modeling analysis. The various data preparation steps taken prior to running the final calibrated MapShed Model for New York are discussed below the table.

Table 7. Information Sources for AVGWLF Model Parameterization

WEATHER.DAT file	
Data	Source or Value
	Historical weather data from Albany Int. Airport NY and Grafton, NY National Weather Services Stations
TRANSPORT.DAT file	
Data	Source or Value
Basin size	GIS/derived from basin boundaries
Land use/cover distribution	GIS/derived from land use/cover map
Curve numbers by source area	GIS/derived from land cover and soil maps
USLE (KLSCP) factors by source area	GIS/derived from soil, DEM, & land cover
ET cover coefficients	GIS/derived from land cover
Erosivity coefficients	GIS/ derived from physiographic map
Daylight hrs. by month	Computed automatically for state

Growing season months	Input by user
Initial saturated storage	Default value of 10 cm
Initial unsaturated storage	Default value of 0 cm
Recession coefficient	Default value of 0.1
Seepage coefficient	Default value of 0
Initial snow amount (cm water)	Default value of 0
Sediment delivery ratio	GIS/based on basin size
Soil water (available water capacity)	GIS/derived from soil map
NUTRIENT.DAT file	
Data	Source or Value
Dissolved N in runoff by land cover type	Default values/adjusted using GWLF Manual
Dissolved P in runoff by land cover type	Default values/adjusted using GWLF Manual
N/P concentrations in manure runoff	Default values/adjusted using AEU density
N/P buildup in urban areas	Default values (from GWLF Manual)
N and P point source loads	Derived from SPDES point coverage
Background N/P concentrations in GW	Derived from new background N map
Background P concentrations in soil	Derived from soil P loading map/adjusted using GWLF Manual
Background N concentrations in soil	Based on map in GWLF Manual
Months of manure spreading	Input by user
Population on septic systems	Derived from census tract maps for 2000 and house counts
Per capita septic system loads (N/P)	Default values/adjusted using AEU density

Land Use

The 2001 NLCD land use coverage was obtained, recoded, and formatted specifically for use in MapShed. The New York State High Resolution Digital Orthoimagery (for the time period 2000 – 2004) was used to perform updates and corrections to the 2001 NLCD land use coverage to more accurately reflect current conditions. Each basin was reviewed independently for the potential need for land use corrections; however individual raster errors associated with inherent imperfections in the satellite imagery have a far greater impact on overall basin land use percentages when evaluating smaller scale basins. As a result, for large basins, NLCD 2001 is generally considered adequate, while in smaller basins, errors were more closely assessed and corrected. The following were the most common types of corrections applied generally to smaller basins:

- 1) Areas of low intensity development that were coded in the 2001 NLCD as other land use types were the most commonly corrected land use data in this analysis. Discretion was used when applying corrections, as some overlap of land use pixels on the lake boundary are inevitable due to the inherent variability in the aerial position of the sensor creating the image. If significant new development was apparent (i.e., on the orthoimagery), but was not coded as such in the 2001 NLCD, than these areas were re-coded to low intensity development.
- 2) Areas of water that were coded as land (and vice-versa) were also corrected. Discretion was used for reservoirs where water level fluctuation could account for errors between orthoimagery and land use.

- 3) Forested areas that were coded as row crops/pasture areas (and vice-versa) were also corrected. For this correction, 100% error in the pixel must exist (e.g., the supposed forest must be completely pastured to make a change); otherwise, making changes would be too subjective. Conversions between forest types (e.g., conifer to deciduous) are too subjective and therefore not attempted; conversions between row crops and pasture are also too subjective due to the practice of crop rotation. Correction of row crops to hay and pasture based on orthoimagery were therefore not undertaken in this analysis.

In addition to the corrections described above, low and high intensity development land uses were further refined for some lakes to differentiate between low, medium, and high density residential; and low, medium, and high density mixed urban areas. These distinctions were based primarily upon the impervious surface coverage and residential or mixed commercial land uses. The following types of refinements were the focus of the land use revision efforts:

- 1) Areas of residential development were identified. Discretion was used in the reclassification of small forested patches embedded within residential areas. Care was taken to maintain the “forest” classification for significant patches of forest within urban areas (e.g. parks, large forested lots within low-density residential areas). Individual trees (or small groups of trees) within residential areas were reclassified to match the surrounding urban classification, in accordance with the land use classifications described in the MapShed manual. Areas identified as lawn grasses surrounding residential structures were reclassified to match the surrounding urban classification, in accordance with the land use classifications in the MapShed manual.
- 2) Areas of medium-density mixed development were identified. Discretion was used during the interpretation and reclassification of urban areas, based on the land use classification definitions in the MapShed manual. When appropriate, pixels were also reclassified as “low” or “high” density mixed development.
- 3) Golf courses were identified and classified appropriately.

Total phosphorus concentrations in runoff from the different urban land uses was acquired from the National Stormwater Quality Database (Pitt, *et al.*, 2008). These data were used to adjust the model’s default phosphorus accumulation rates. These adjustments were made using best professional judgment based on examination of specific watershed characteristics and conditions.

Phosphorus retention in wetlands and open waters in the basin can be accounted for in MapShed. MapShed recommends the following coefficients for wetlands and pond retention in the northeast: nitrogen (0.12), phosphorus (0.25), and sediment (0.90). Wetland retention coefficients for large, naturally occurring wetlands vary greatly in the available literature. Depending on the type, size and quantity of wetland observed, the overall impact of the wetland retention routine on the original watershed loading estimates, and local information regarding the impact of wetlands on watershed loads, wetland retention coefficients defaults were adjusted accordingly. The percentage of the drainage basin area that drains through a wetland area was calculated and used in conjunction with nutrient retention coefficients in MapShed. To determine the percent wetland area, the total basin land use area was derived using ArcView. Of this total basin area, the area that drains through emergent and woody wetlands were delineated to yield an estimate of total watershed area draining through wetland areas. If a basin displays large areas of surface water (ponds) aside from the water

body being modeled, then this open water area is calculated by subtracting the water body area from the total surface water area.

On-site Wastewater Treatment Systems (“septic tanks”)

MapShed, following the method from GWLF, simulates nutrient loads from septic systems as a function of the percentage of the unsewered population served by normally functioning vs. three types of malfunctioning systems: ponded, short-circuited, and direct discharge (Haith et al., 1992).

- **Normal Systems** are septic systems whose construction and operation conforms to recommended procedures, such as those suggested by the EPA design manual for on-site wastewater disposal systems. Effluent from normal systems infiltrates into the soil and enters the shallow saturated zone. Phosphates in the effluent are adsorbed and retained by the soil and hence normal systems provide no phosphorus loads to nearby waters.
- **Short-Circuited Systems** are located close enough to surface water (~15 meters) so that negligible adsorption of phosphorus takes place. The only nutrient removal mechanism is plant uptake. Therefore, these systems are always contributing to nearby waters.
- **Ponded Systems** exhibit hydraulic malfunctioning of the tank’s absorption field and resulting surfacing of the effluent. Unless the surfaced effluent freezes, ponding systems deliver their nutrient loads to surface waters in the same month that they are generated through overland flow. If the temperature is below freezing, the surfacing is assumed to freeze in a thin layer at the ground surface. The accumulated frozen effluent melts when the snowpack disappears and the temperature is above freezing.
- **Direct Discharge Systems** illegally discharge septic tank effluent directly into surface waters.

MapShed requires an estimation of population served by septic systems to generate septic system phosphorus loadings. In reviewing the orthoimagery for the lake, it became apparent that septic system estimates from the 1990 census were not reflective of actual population in close proximity to the shore. Shoreline dwellings immediately surrounding the lake account for a substantial portion of the nutrient loading to the lake. Therefore, the estimated number of septic systems in the drainage basin was refined using a combination of 1990 and 2000 census data and GIS analysis of orthoimagery to account for the proximity of septic systems immediately surrounding the lake. If available, local information about the number of houses within 250 feet of the lakes was obtained and applied. Great attention was given to estimating septic systems within 250 feet of the lake (those most likely to have an impact on the lake). To convert the estimated number of septic systems to population served, an average household size of 2.61 people per dwelling was used based on the circa 2000 USCB census estimate for number of persons per household in New York State.

MapShed also requires an estimate of the number of normal and malfunctioning septic systems. This information was not readily available for the lake. Therefore, several assumptions were made to categorize the systems according to their performance. These assumptions are based on data from local and national studies (Day, 2001; USEPA, 2002) in combination with best professional judgment. To account for seasonal variations in population, data from the 2000 census were used to estimate the percentage of seasonal homes for the town(s) surrounding the lake. The failure rate for septic systems closer to the lake (i.e., within 250 feet) were adjusted to account for increased loads due to greater occupancy during the summer months. If available, local information about seasonal

occupancy was obtained and applied. For the purposes of this analysis, seasonal homes are considered those occupied only during the month of June, July, and August.

Groundwater Phosphorus

Phosphorus concentrations in groundwater discharge are derived by MapShed. Watersheds with a high percentage of forested land will have low groundwater phosphorus concentrations while watersheds with a high percentage of agricultural land will have high concentrations. The GWLF manual provides estimated groundwater phosphorus concentrations according to land use for the eastern United States. Completely forested watersheds have values of 0.006 mg/L. Primarily agricultural watersheds have values of 0.104 mg/L. Intermediate values are also reported. The MapShed-generated groundwater phosphorus concentration was evaluated to ensure groundwater phosphorus values reasonably reflect the actual land use composition of the drainage basin and modifications were made if deemed unnecessary.

Point Sources

If permitted point sources exist in the drainage basin, their location was identified and verified by NYS DEC and an estimated monthly total phosphorus load and flow was determined using either actual reported data (e.g., from discharge monitoring reports) or estimated based on expected discharge/flow for the facility type.

Concentrated Animal Feeding Operations (CAFOs)

A state-wide Concentrated Animal Feeding Operation (CAFO) shapefile was provided by NYS DEC. CAFOs are categorized as either large or medium. The CAFO point can represent either the centroid of the farm or the entrance of the farm, therefore the CAFO point is more of a general gauge as to where further information should be obtained regarding permitted information for the CAFO. If a CAFO point is located in or around a basin, orthos and permit data were evaluated to determine the part of the farm with the highest potential contribution of nutrient load. In ArcView, the CAFO shapefile was positioned over the basin and clipped with a 2.5 mile buffer to preserve those CAFOS that may have associated cropland in the basin. If a CAFO point is found to be located within the boundaries of the drainage basin, every effort was made to obtain permit information regarding nutrient management or other best management practices (BMPs) that may be in place within the property boundary of a given CAFO. These data can be used to update the nutrient file in MapShed and ultimately account for agricultural BMPs that may currently be in place in the drainage basin.

Municipal Separate Storm Sewer Systems (MS4s)

Stormwater runoff within Phase II permitted Municipal Separate Storm Sewer Systems (MS4s) is considered a point source of pollutants. Stormwater runoff outside of the MS4 is non-permitted stormwater runoff and, therefore, considered nonpoint sources of pollutants. Permitted stormwater runoff is accounted for in the wasteload allocation of a TMDL, while non-permitted runoff is accounted for in the load allocation of a TMDL.

MapShed Model Simulation Results

Input Transport File

Rural LU							Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Area (ha)	CN	K	LS	C	P								
Hay/Past	63	75	0.24	0.153	0.03	0.52	Jan	0.78	9.2	0	0.06	0	0
Cropland	1	82	0.23	0.0	0.32	0.52	Feb	0.98	10.2	0	0.06	0	0
Forest	124	73	0.234	0.236	0.002	0.52	Mar	1.13	11.7	0	0.06	0	0
	0	0	0	0	0	0	Apr	1.25	13.3	0	0.25	0	0
	0	0	0	0	0	0	May	1.43	14.6	1	0.25	0	0
	0	0	0	0	0	0	Jun	1.57	15.1	1	0.25	0	0
	0	0	0	0	0	0	Jul	1.68	14.8	1	0.25	0	0
Bare Land							Aug	1.76	13.8	1	0.25	0	0
Area (ha)	CN	K	LS	C	P	Sep	1.82	12.3	1	0.06	0	0	
0	0	0	0	0	0	Oct	1.77	10.7	0	0.06	0	0	
0	0	0	0	0	0	Nov	1.72	9.4	0	0.06	0	0	
Urban LU							Dec	1.69	8.9	0	0.06	0	0
Area (ha)	CN	K	LS	C	P								
Lo_Int_Dev	25	83	0.236	0.128	0.08	0.2							
Hi_Int_Dev	2	93	0.24	0.018	0.08	0.2							

Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.05
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.1933	Seepage Coefficient	0
Unsat Avail Wat (cm)	0.56369	Tile Drain Ratio	0.5	Sediment A Factor	7.8391E-05
		Tile Drain Density	0		

Input Nutrient File

Runoff Coefficients by Source			Nitrogen and Phosphorus Loads from Point Sources and Septic Systems							
Rural Runoff	Dis N mg/L	Dis P mg/L	Point Source Loads/Discharge			Septic System Populations				
Hay/Past	2.9	0.281	Month	Kg N	Kg P	Discharge MGD	Normal Systems	Pond Systems	Short Cir Systems	Discharge Systems
Cropland	2.9	0.281	Jan	0.0	0.0	0.0	0	0	0	0
Forest	0.19	0.006	Feb	0.0	0.0	0.0	0	0	0	0
	0	0	Mar	0.0	0.0	0.0	0	0	0	0
	0	0	Apr	0.0	0.0	0.0	0	0	0	0
	0	0	May	0.0	0.0	0.0	0	0	0	0
	0	0	Jun	0.0	0.0	0.0	0	0	0	0
	0	0	Jul	0.0	0.0	0.0	0	0	0	0
	0	0	Aug	0.0	0.0	0.0	0	0	0	0
	0	0	Sep	0.0	0.0	0.0	0	0	0	0
Manure	2.44	0.38	Oct	0.0	0.0	0.0	0	0	0	0
Urban Build-Up	N Kg/ha/d	P Kg/ha/d	Nov	0.0	0.0	0.0	0	0	0	0
Lo_Int_Dev	0.012	0.002	Dec	0.0	0.0	0.0	0	0	0	0
Hi_Int_Dev	0.101	0.011								

Groundwater (mg/L)		Tile Drainage (mg/L)			Per capita tank effluent		Growing season N/P uptake		Sediment	
N (mg/L)	P (mg/L)	N	Sed	N (g/d)	P (g/d)	N (g/d)	P (g/d)	N (mg/Kg)	P (mg/Kg)	
0.796	0.012	15	0.1	50	12	2.5	1.6	0.4	3000.0	718.0

Input RUNQUAL File

Landuse Categories					Nitrogen (Kg/Ha/day)			Phosphorus (Kg/Ha/day)			TSS
	Area (Ha)	% Imp	CNI	CNP	Acc Imp	Acc Perv	Dis Fract	Acc Imp	Acc Perv	Dis Fract	EMC (mg/L)
LD_Mixed	25	0.15	92	74	0.045	0.012	0.33	0.0112	0.0019	0.4	60
Md_Mixed	0	0	0	0	0	0	0	0	0	0	0
HD_Mixed	2	0.87	98	79	0.101	0.012	0.33	0.0112	0.0019	0.4	80
LD_Residential	33	0.15	92	74	0.045	0.012	0.28	0.0112	0.0016	0.37	90
MD_Residential	38	0.52	92	74	0.09	0.022	0.28	0.0112	0.0039	0.37	100
Hd_Residential	0	0	0	0	0	0	0	0	0	0	0
Open_Land	188	0.05	90	74	EMC (mg/L) 1.5			EMC (mg/L) 0.12			90

Subsurface Flow		Streambank Erosion		Urban BMPs			
GW N (mg/L)	0.8647	A Factor	1.4251E-03	Streams (Km)	2	Soil N (ppm)	50.0
GW P (mg/L)	0.0503	Hardened Streams (Km)	0	Soil P (ppm)	100.0	Detention Basins	
						Detention basin volume (m ³)	0
						Basin dead storage (m ³)	0
						Basin surface area (m ²)	0
						Basin days to drain	0
						Basin cleaning month	0
						Infiltration and Buffer Strips	
						Infiltration retention runoff (cm)	0
						Fraction of area treated (0 - 1)	0.0
						Vegetative buffer strip width (m)	0
						Fraction of streams treated (0 - 1)	0.0
						Combined Sewer Overflows	
						Avg. raw sewage N (mg/L)	35
						Avg. raw sewage P (mg/L)	10
						Critical rainfall (cm/day)	1

Day Hrs/Grow Seas.			Point Sources			Street Sweeping	
Month	Day Hrs	Grow	Adjust. % ET	Kg N	Kg P	Discharge MGD	No per month
Jan	9.2	0	1	0	0	0.0	0
Feb	10.2	0	1	0	0	0.0	0
Mar	11.7	0	1	0	0	0.0	0
Apr	13.3	0	1	0	0	0.0	0
May	14.6	1	1	0	0	0.0	0
Jun	15.1	1	1	0	0	0.0	0
Jul	14.8	1	1	0	0	0.0	0
Aug	13.8	1	1	0	0	0.0	0
Sep	12.3	1	1	0	0	0.0	0
Oct	10.7	0	1	0	0	0.0	0
Nov	9.4	0	1	0	0	0.0	0
Dec	8.9	0	1	0	0	0.0	0

GW Seep and GW Recess Coef	
GW Seep	0
GW Recess	0.05

APPENDIX B. BATHHTUB MODELING ANALYSIS

Model Overview

BATHHTUB is a steady-state (Windows-based) water quality model developed by the U. S. Army Corps of Engineers (USACOE) Waterways Experimental Station. BATHHTUB performs steady-state water and nutrient balance calculations for spatially segmented hydraulic networks in order to simulate eutrophication-related water quality conditions in lakes and reservoirs. BATHHTUB's nutrient balance procedure assumes that the net accumulation of nutrients in a lake is the difference between nutrient loadings into the lake (from various sources) and the nutrients carried out through outflow and the losses of nutrients through whatever decay process occurs inside the lake. The net accumulation (of phosphorus) in the lake is calculated using the following equation:

$$\text{Net accumulation} = \text{Inflow} - \text{Outflow} - \text{Decay}$$

The pollutant dynamics in the lake are assumed to be at a steady state, therefore, the net accumulation of phosphorus in the lake equals zero. BATHHTUB accounts for advective and diffusive transport, as well as nutrient sedimentation. BATHHTUB predicts eutrophication-related water quality conditions (total phosphorus, total nitrogen, chlorophyll-a, transparency, and hypolimnetic oxygen depletion) using empirical relationships derived from assessments of reservoir data. Applications of BATHHTUB are limited to steady-state evaluations of relations between nutrient loading, transparency and hydrology, and eutrophication responses. Short-term responses and effects related to structural modifications or responses to variables other than nutrients cannot be explicitly evaluated.

Input data requirements for BATHHTUB include: physical characteristics of the watershed lake morphology (e.g., surface area, mean depth, length, mixed layer depth), flow and nutrient loading from various pollutant sources, precipitation (from nearby weather station) and phosphorus concentrations in precipitation (measured or estimated), and measured lake water quality data (e.g., total phosphorus concentrations).

The empirical models implemented in BATHHTUB are mathematical generalizations about lake behavior. When applied to data from a particular lake, actual observed lake water quality data may differ from BATHHTUB predictions by a factor of two or more. Such differences reflect data limitations (measurement or estimation errors in the average inflow and outflow concentrations) or the unique features of a particular lake (no two lakes are the same). BATHHTUB's "calibration factor" provides model users with a method to calibrate the magnitude of predicted lake response. The model calibrated to current conditions (against measured data from the lakes) can be applied to predict changes in lake conditions likely to result from specific management scenarios, under the condition that the calibration factor remains constant for all prediction scenarios.

Model Set-up

Using descriptive information about Snyders Lake and its surrounding drainage area, as well as output from MapShed, a BATHHTUB model was set up for Snyders Lake. Mean annual phosphorus loading to the lake was simulated using MapShed for the period 1990-2007. After initial model development, NYS DEC sampling data were used to assess the model's predictive capabilities and, if necessary, "fine tune" various input parameters and sub-model selections within BATHHTUB during

a calibration process. Once calibrated, BATHTUB was used to derive the total phosphorus load reduction needed in order to achieve the TMDL target.

Sources of input data for BATHTUB include:

- Physical characteristics of the watershed and lake morphology (e.g., surface area, mean depth, length, mixed layer depth) - Obtained from CSLAP and bathymetric maps provided by NYS DEC or created by the Cadmus Group, Inc.
- Flow and nutrient loading from various pollutant sources - Obtained from MapShed output.
- Precipitation – Obtained from nearby National Weather Services Stations.
- Phosphorus concentrations in precipitation (measured or estimated), and measured lake water quality data (e.g., total phosphorus concentrations) – Obtained from NYS DEC.

Tables 8 – 11 summarize the primary model inputs for Snyders Lake, including the coefficient of variation (CV), which reflects uncertainty in the input value. Default model choices are utilized unless otherwise noted. Spatial variations (i.e., longitudinal dispersion) in phosphorus concentrations are not a factor in the development of the TMDL for Snyders Lake. Therefore, division of the lake into multiple segments was not necessary for this modeling effort. Modeling the entire lake with one segment provides predictions of area-weighted mean concentrations, which are adequate to support management decisions. Water inflow and nutrient loads from the lake's drainage basin were treated as though they originated from one "tributary" (i.e., source) in BATHTUB and derived from MapShed.

BATHTUB is a steady state model, whose predictions represent concentrations averaged over a period of time. A key decision in the application of BATHTUB is the selection of the length of time over which water and mass balance calculations are modeled (the "averaging period"). The length of the appropriate averaging period for BATHTUB application depends upon what is called the nutrient residence time, which is the average length of time that phosphorus spends in the water column before settling or flushing out of the lake. Guidance for BATHTUB recommends that the averaging period used for the analysis be at least twice as large as nutrient residence time for the lake. The appropriate averaging period for water and mass balance calculations would be 1 year for lakes with relatively long nutrient residence times or seasonal (6 months) for lakes with relatively short nutrient residence times (e.g., on the order of 1 to 3 months). The turnover ratio can be used as a guide for selecting the appropriate averaging period. A seasonal averaging period (April/May through September) is usually appropriate if it results in a turnover ratio exceeding 2.0. An annual averaging period may be used otherwise. Other considerations (such as comparisons of observed and predicted nutrient levels) can also be used as a basis for selecting an appropriate averaging period, particularly if the turnover ratio is near 2.0.

Precipitation inputs were taken from the observed long term mean daily total precipitation values from the Albany Int. Airport, NY and Grafton, NY National Weather Services Stations for the 1990-2007 period. Evapotranspiration was derived from MapShed using daily weather data (1990-2007) and a cover factor dependent upon land use/cover type. The values selected for precipitation and change in lake storage have very little influence on model predictions. Atmospheric phosphorus loads were specified using data collected by NYS DEC from the Cedar Lane Atmospheric

Deposition Station located in Lake George Village, in Warren County. Atmospheric deposition is not a major source of phosphorus loading to Snyders Lake and has little impact on simulations.

Lake surface area, mean depth, and length were derived using GIS analysis of bathymetric data. Depth of the mixed layer was estimated using a multivariate regression equation developed by Walker (1996). Existing water quality conditions in Snyders Lake were represented using an average of the observed summer mean phosphorus concentrations for years 1996-2001 (excluding 1998). These data were collected through NYS DEC's CSLAP. The concentration of phosphorus loading to the lake was calculated using the average annual flow and phosphorus loads simulated by MapShed. To obtain flow in units of volume per time, the depth of flow was multiplied by the drainage area and divided by one year. To obtain phosphorus concentrations, the nutrient mass was divided by the volume of flow.

Internal loading rates reflect nutrient recycling from bottom sediments. Internal loading rates are normally set to zero in BATHTUB since the pre-calibrated nutrient retention models already account for nutrient recycling that would normally occur (Walker, 1999). Walker warns that nonzero values should be specified with caution and only if independent estimates or measurements are available. In some studies, internal loading rates have been estimated from measured phosphorus accumulation in the hypolimnion during the stratified period. Results from this procedure should not be used for estimation of internal loading in BATHTUB unless there is evidence the accumulated phosphorus is transported to the mixed layer during the growing season. Specification of a fixed internal loading rate may be unrealistic for evaluating response to changes in external load. Because they reflect recycling of phosphorus that originally entered the reservoir from the watershed, internal loading rates would be expected to vary with external load. In situations where monitoring data indicate relatively high internal recycling rates to the mixed layer during the growing season, a preferred approach would generally be to calibrate the phosphorus sedimentation rate (i.e., specify calibration factors < 1). However, there still remains some risk that apparent internal loads actually reflect under-estimation of external loads.

Table 8. BATHTUB Model Input Variables: Model Selections

Water Quality Indicator	Option	Description
Total Phosphorus	01	2 nd Order Available Phosphorus*
Phosphorus Calibration	01	Decay Rate*
Error Analysis	01	Model and Data*
Availability Factors	00	Ignore*
Mass Balance Tables	01	Use Estimated Concentrations*

* Default model choice

Table 9. BATHTUB Model Input: Global Variables

Model Input	Mean	CV
Averaging Period (years)	1	NA
Precipitation (meters)	1.098	0.2*
Evaporation (meters)	0.431	0.3*
Atmospheric Load (mg/m ² -yr)- Total P	4.829	0.5*
Atmospheric Load (mg/m ² -yr)- Ortho P	2.907	0.5*

* Default model choice

Table 10. BATHTUB Model Input: Lake Variables

Morphometry	Mean	CV
Surface Area (km ²)	0.44	NA
Mean Depth (m)	6.15	NA
Length (km)	1.18	NA
Estimated Mixed Depth (m)	5.3	0.12
Observed Water Quality	Mean	CV
Total Phosphorus (ppb)	17.71	0.5

* Default model choice

Table 11. BATHTUB Model Input: Watershed “Tributary” Loading

Monitored Inputs	Mean	CV
Total Watershed Area (km ²)	2.86	NA
Flow Rate (hm ³ /yr)	1.909	0.1
Total P (ppb)	44.509	0.2
Organic P (ppb)	28.182	0.2

Model Calibration

BATHTUB model calibration consists of:

1. Applying the model with all inputs specified as above
2. Comparing model results to observed phosphorus data
3. Adjusting model coefficients to provide the best comparison between model predictions and observed phosphorus data (only if absolutely required and with extreme caution).

Several t-statistics calculated by BATHTUB provide statistical comparison of observed and predicted concentrations and can be used to guide calibration of BATHTUB. Two statistics supplied by the model, T2 and T3, aid in testing model applicability. T2 is based on error typical of model development data set. T3 is based on observed and predicted error, taking into consideration model inputs and inherent model error. These statistics indicate whether the means differ significantly at the 95% confidence level. If their absolute values exceed 2, the model may not be appropriately calibrated. The T1 statistic can be used to determine whether additional calibration is desirable. The t-statistics for the BATHUB simulations for Snyders Lake are as follows:

Year	Observed	Simulated	T1	T2	T3
1996	16	21	-0.51	-0.94	-0.47
1997	18	19	-0.16	-0.29	-0.15
1999	17	21	-0.40	-0.74	-0.37
2000	23	21	0.20	0.37	0.18
2001	14	19	-0.59	-1.10	-0.55
Average	18	19	-0.14	-0.26	-0.13

In cases where predicted and observed values differ significantly, calibration coefficients can be adjusted to account for the site-specific application of the model. Calibration to account for model error is often appropriate. However, Walker (1996) recommends a conservative approach to calibration since differences can result from factors such as measurement error and random data input errors. Error statistics calculated by BATHTUB indicate that the match between simulated and observed mean annual water quality conditions in Snyders Lake is quite good. Therefore, BATHTUB is sufficiently calibrated for use in estimating load reductions required to achieve the phosphorus TMDL target in the lake.

APPENDIX C. TOTAL EQUIVALENT DAILY PHOSPHORUS LOAD ALLOCATIONS

Source	Total Phosphorus Load (lbs/d)			% Reduction
	Current	Allocated	Reduction	
Agriculture*	0.147965	0.140550	0.007415	5%
Developed Land (non-regulated groundwater)	0.042160	0.040053	0.002107	5%
Forest, Wetland, Stream Bank, and Natural Background*	0.033023	0.033023	0.000000	0%
LOAD ALLOCATION	0.223148	0.213626	0.009522	4%
Developed Land (regulated MS4 stormwater)	0.289724	0.258826	0.030898	11%
WASTELOAD ALLOCATION	0.289724	0.258826	0.030898	11%
LA + WLA	0.512872	0.472452	0.04042	8%
Margin of Safety	MOS of 10% built into the TMDL endpoint			
TOTAL	0.512872	0.472452	---	---

* Includes phosphorus transported through surface runoff and subsurface (groundwater)

Exhibit 7

Geographic Areas of Concern

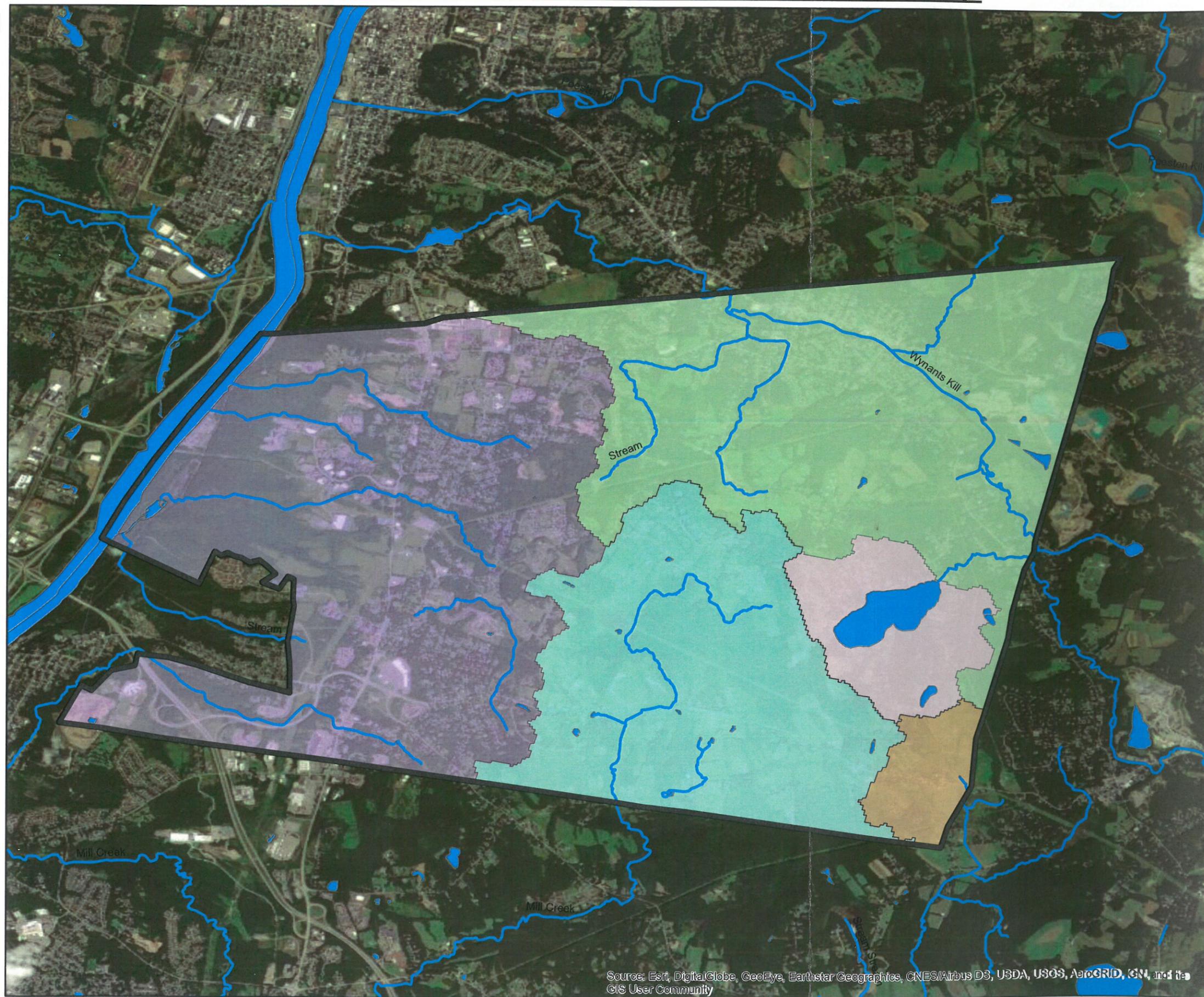
The Town is currently working on formalizing the identification of Geographic Areas of Concern (GOCs) within the municipality. Based upon preliminary discussions, the following general factors are being used in identifying GOCs:

- The size and importance of a watershed for draining an area within the Town. This is coupled with the degree of development within the watershed and the potential for adverse effects on the Town's stormwater management. Based upon these criteria, as indicated on the attached maps, the following areas are under consideration:
 - The Wynantskill Creek Watershed. This watershed drains approximately 53% of the lands within the Town and is moderately developed.
 - Minor Hudson River Tributaries: This watershed drains approximately 35% of the lands within the Town and is moderately developed, with the exception of a portion of the watershed that slopes substantially just east of the Hudson River.
- The slope of the area and the potential to produce high-velocity runoff events, particularly in areas that are moderately developed. Based upon these criteria, the following areas are under consideration:
 - Lands just east of the Hudson River. Although this area is generally well drained by a series of natural tributaries, the slope of the terrain has the potential to produce high-velocity flows under larger storm volumes. As development in the area to the east of this vicinity continues, the potential for undesirable stormwater events may increase.
 - The area around North Road. At the upper portion of the Wynantskill watershed, this area is a relatively high point within the Town and an area of moderate slope. Additionally, this section of Town continues to be aggressively developed.
- The nature of businesses within the area and the potential for environmental incidents related to Pollutants of Concern (POCs), particularly Gross Solids, Organics, and Oil and Grease as identified in Exhibit 2. Based upon these criteria, the following areas are under consideration:
 - The Route 4 Corridor. Several businesses along Route 4, particularly at the northern and southern sections within the Town, have the potential to generate the POCs listed above.
 - The Main Avenue Corridor. Similar to Route 4, several businesses along Main Avenue have the potential to generate POCs.
- Areas identified as being valuable resources. The Town has just begun a natural resources and open spaces evaluation and mapping program which is intended to identify various areas of value within the Town in several tangible and intangible categories. The results

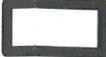
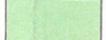
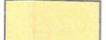
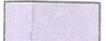
of this program will help determine GOCs. Additionally, the GIS mapping system utilized as part of this activity will be incorporated into the GOC program.

The Town anticipates defining and mapping GOCs within the upcoming year.

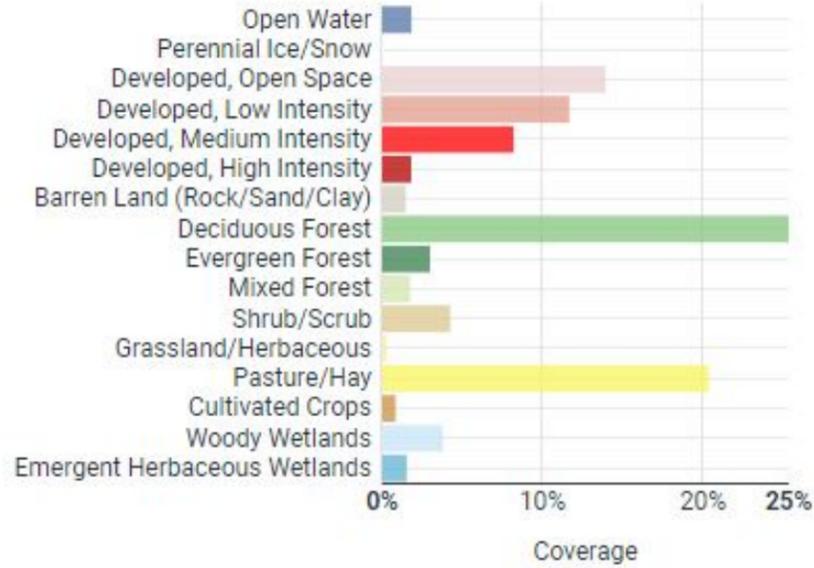
Town of North Greenbush Watershed Map



Legend

-  Town Border
-  Waterbodies
-  Snyder's Lake Watershed
-  Wynants Kill Watershed
-  Mill Creek Watershed
-  North Branch Moordener Kill Watershed
-  Hudson River Tributaries Watershed

Town of North Greenbush Land Cover Map



Type	Area (km ²)	Coverage (%)
Open Water	0.89	1.76%
Perennial Ice/Snow	0	0.00%
Developed, Open Space	6.87	13.55%
Developed, Low Intensity	5.76	11.36%
Developed, Medium Intensity	4.04	7.97%
Developed, High Intensity	0.9	1.77%
Barren Land (Rock/Sand/Clay)	1.63	3.21%
Deciduous Forest	12.51	24.67%
Evergreen Forest	1.48	2.92%
Mixed Forest	1	1.97%
Shrub/Scrub	2.28	4.50%
Grassland/Herbaceous	0.25	0.49%
Pasture/Hay	10.05	19.82%
Cultivated Crops	0.42	0.83%
Woody Wetlands	1.87	3.69%
Emergent Herbaceous Wetlands	0.76	1.50%
Total	50.71	100.00%

Type	Coverage (%)
Agricultural	±20%
Developed	±33%
Retail/Mixed	±2%
Forests & Wetlands	±40%

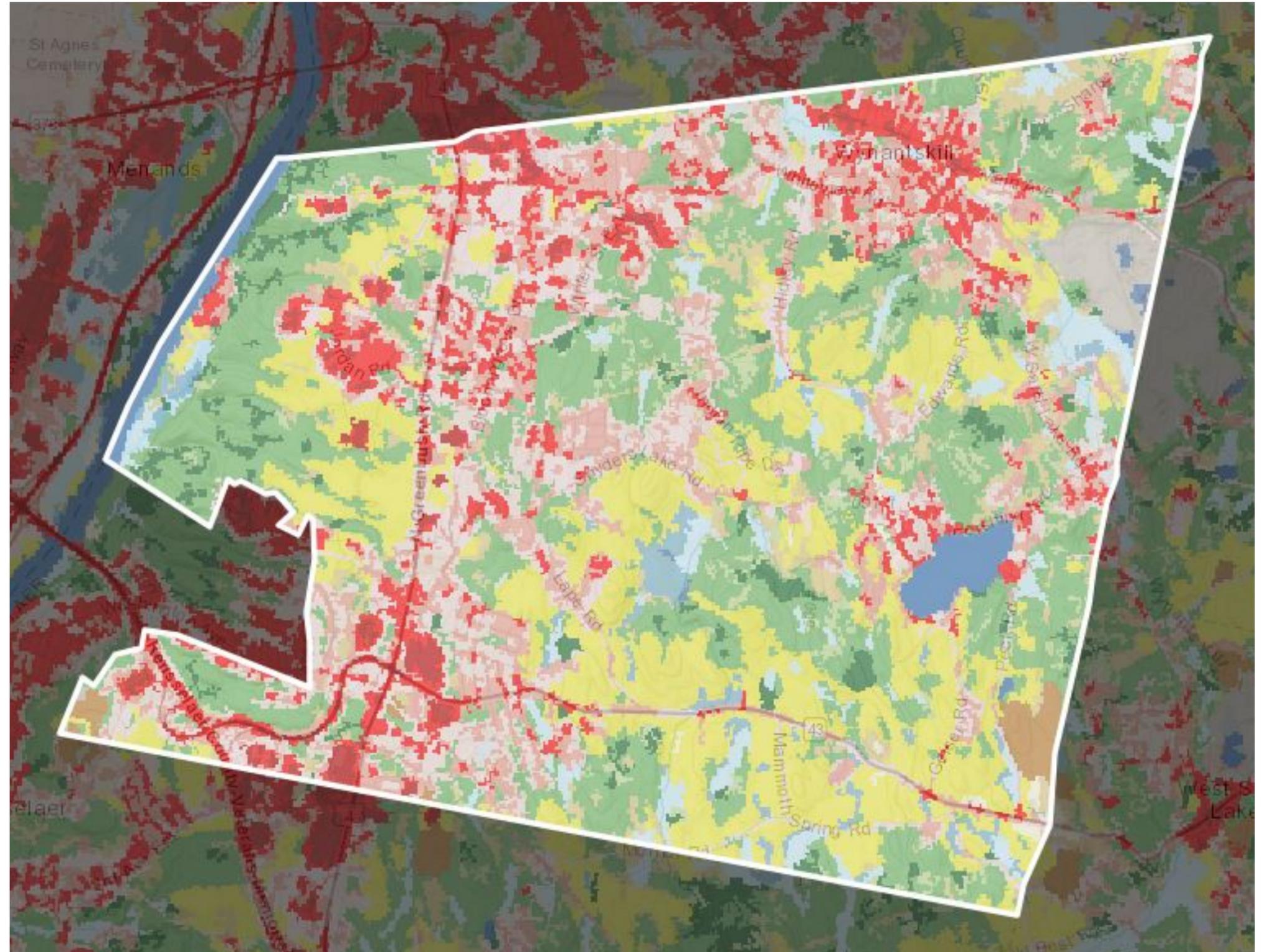


Exhibit 8

Town of North Greenbush Annual MS4 Report

Included in this Exhibit is the MS4 Annual Report Form for the reporting period ending March 09, 2021. MS4 Annual Report Forms for previous years are archived in a separate binder located at the Town Building Department and are also included on the Town's Stormwater web page.

MS4 Municipal Compliance Certification(MCC) Form

MCC form for period ending March 9,

Name of MS4

SPDES ID

Section 2 - Contact Information

Important Instructions - Please Read

Contact information must be provided for ***each*** of the following positions as indicated below:

1. Principal Executive Officer, Chief Elected Official or other qualified individual (per GP-0-08-002 Part VI.J).
2. Duly Authorized Representative (Information for this contact must only be submitted if a Duly Authorized Representative is signing this form)
3. The Local Stormwater Public Contact (required per GP-0-08-002 Part VII.A.2.c & Part VIII.A.2.c).
4. The Stormwater Management Program (SWMP) Coordinator (Individual responsible for coordination/implementation of SWMP).
5. Report Preparer (Consultants may provide company name in the space provided).

A separate sheet must be submitted for each position listed above unless more than one position is filled by the same individual. If one individual fills multiple roles, provide the contact information once and check all positions that apply to that individual.

If a new Duly Authorized Representative is signing this report, their contact information must be provided and a signature authorization form, signed by the Principal Executive Officer or Chief Elected Official must be attached.

For each contact, select all that apply:

- Principal Executive Officer/Chief Elected Official
- Duly Authorized Representative
- Local Stormwater Public Contact
- Stormwater Management Program (SWMP) Coordinator
- Report Preparer

First Name MI Last Name

Title

Address

City State Zip -

eMail

Phone () - County

MS4 Municipal Compliance Certification(MCC) Form

MCC form for period ending March 9,

Name of MS4

SPDES ID

Section 4 - Certification Statement

"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, 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."

This form must be signed by either a principal executive officer or ranking elected official, or duly authorized representative of that person as described in GP-0-08-002 Part VI.J.

First Name MI Last Name

Title (Clearly print title of individual signing report)

Signature

Date / /

The annual report form and any attachments can be sent to the DEC Central Office clicking the Submit Form link below, or by sending it directly to: MS4compliance@dec.ny.gov. All submissions must include the SPDES ID in the title and must be complete before hitting the Submit Form link below:

Submit Form

If unable to submit electronically, hardcopy submissions can be sent to:

Bureau of Water Compliance
Division of Water
4th Floor
625 Broadway
Albany, New York 12233-3505

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

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SPDES ID

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4. Evaluating Progress Toward Measurable Goals MCM 1

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.

B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.

C. How many times was this observation measured or evaluated in this reporting period?

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(ex.: samples/participants/events)

D. Has your MS4 made progress toward this Measurable Goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measure 2. Public Involvement/Participation

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

1. What opportunities were provided for public participation in implementation, development, evaluation and improvement of the Stormwater Management Program (SWMP) Plan during this reporting period? Check all that apply:

- Cleanup Events # Events
- Comments on SWMP Received # Comments
- Community Hotlines Phone # () -
- Phone # () - Phone # () -
- Phone # () - Phone # () -
- Phone # () - Phone # () -
- Phone # () - Phone # () -
- Phone # () - Phone # () -
- Community Meetings # Attendees
- Plantings Sq. Ft.
- Storm Drain Markings # Drains
- Stakeholder Meetings # Attendees
- Volunteer Monitoring # Events
- Other:

2. Was public notice of availability of this annual report and Stormwater Management Program (SWMP) Plan provided? Yes No

- List-Serve # In List
- Newspaper Advertising # Days Run
- TV/Radio Notices # Days Run
- Other:
- Web Page URL: Enter URL(s) on the following two pages.

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition SPDES ID

4.a. If this report was made available on the internet, what date was it posted?

Leave blank if this report was not posted on the internet.

/ /

4.b. For how many days was/will this report be posted?

If submitting a report for single MS4, answer 5.a.. If submitting a joint report, answer 5.b..

5.a. Was an Annual Report public meeting held in this reporting period?

Yes No

If Yes, what was the date of the meeting?

/ /

If No, is one planned?

Yes No

5.b. Was an Annual Report public meeting held for all MS4s contributing to this report during this reporting period?

Yes No

If No, is one planned for each?

Yes No

6. Were comments received during this reporting period?

Yes No

If Yes, attach comments, responses and changes made to SWMP in response to comments to this report.

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

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SPDES ID

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7. Evaluating Progress Toward Measurable Goals MCM 2

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.

B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.

C. How many times was this observation measured or evaluated in this reporting period?

--	--	--	--	--

(ex.: samples/participants/events)

D. Has your MS4 made progress toward this measurable goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measure 3. Illicit Discharge Detection and Elimination

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

1. Enter the number and approx. percent of outfalls mapped: # %

2. How many of these outfalls have been screened for dry weather discharges during this reporting period (outfall reconnaissance inventory)?

3.a. What types of generating sites/sewersheds were targeted for inspection during this reporting period?

- Auto Recyclers
- Building Maintenance
- Churches
- Commercial Carwashes
- Commercial Laundry/Dry Cleaners
- Construction Vehicle Washouts
- Cross-Connections
- Distribution Centers
- Food Processing Facilities
- Garbage Truck Washouts
- Hospitals
- Improper RV Waste Disposal
- Industrial Process Water
- Other:
- Landscaping (Irrigation)
- Marinas
- Metal Plateing Operations
- Outdoor Fluid Storage
- Parking Lot Maintenance
- Printing
- Residential Carwashing
- Restaurants
- Schools and Universities
- Septic Maintenance
- Swimming Pools
- Vehicle Fueling
- Vehicle Maint./Repair Shops
- None

Sewersheds:

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

3.b. What types of illicit discharges have been found during this reporting period?

- Broken Lines From Sanitary Sewer
- Industrial Connections
- Cross Connections
- Inflow/Infiltration
- Failing Septic Systems
- Pump Station Failure
- Floor Drains Connected To Storm Sewers
- Sanitary Sewer Overflows
- Illegal Dumping
- Straight Pipe Sewer Discharges
- Other:
- None

4. How many illicit discharges/potential illegal connections have been detected during this reporting period?

5. How many illicit discharges have been confirmed during this reporting period?

6. How many illicit discharges/illegal connections have been eliminated during this reporting period?

7. Has the storm sewershed mapping been completed in this reporting period? Yes No
If No, approximately what percent was completed in this reporting period?

%

8. Is the above information available in GIS? Yes No
Is this information available on the web? Yes No

If Yes, provide URL(s):

Please provide specific address of page where map(s) can be accessed - not home page.

URL

URL

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

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12. Evaluating Progress Toward Measurable Goals MCM 3

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.

B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.

C. How many times was this observation measured or evaluated in this reporting period?

--	--	--	--	--

(ex.: samples/participants/events)

D. Has your MS4 made progress toward this measurable goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measures 4 and 5.
Construction Site and Post-Construction Control

The information in this section is being reported (check one):

- On behalf of an individual MS4
 On behalf of a coalition

How many MS4s contributed to this report?

1a. Has each MS4 contributing to this report adopted a law, ordinance or other regulatory mechanism that provides equivalent protection to the NYS SPDES General Permit for Stormwater Discharges from Construction Activities? Yes No

1b. Has each Town, City and/or Village contributing to this report documented that the law is equivalent to a NYSDEC Sample Local Law for Stormwater Management and Erosion and Sediment Control through either an attorney certification or using the NYSDEC Gap Analysis Workbook? Yes No NT

If Yes, Towns, Cities and Villages provide date of equivalent NYS Sample Local Law.

09/2004 03/2006 NT

2. Does your MS4/Coalition have a SWPPP review procedure in place? Yes No

3. How many Construction Stormwater Pollution Prevention Plans (SWPPPs) have been reviewed in this reporting period?

4. Does your MS4/Coalition have a mechanism for receipt and consideration of public comments related to construction SWPPPs? Yes No NT

If Yes, how many public comments were received during this reporting period?

5. Does your MS4/Coalition provide education and training for contractors about the local SWPPP process? Yes No

6. Identify which of the following types of enforcement actions you used during the reporting period for construction activities, indicate the number of actions, or note those for which you do not have authority:

- Notices of Violation #

--	--	--	--	--	--

 ○ No Authority
- Stop Work Orders #

--	--	--	--	--	--

 ○ No Authority
- Criminal Actions #

--	--	--	--	--	--

 ○ No Authority
- Termination of Contracts #

--	--	--	--	--	--

 ○ No Authority
- Administrative Fines #

--	--	--	--	--	--

 ○ No Authority
- Civil Penalties #

--	--	--	--	--	--

 ○ No Authority
- Administrative Orders #

--	--	--	--	--	--

 ○ No Authority
- Enforcement Actions or Sanctions #

--	--	--	--	--	--

 ○ No Authority
- Other #

--	--	--	--	--	--

 ○ No Authority

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measure 4. Construction Site Stormwater Runoff Control

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

1. How many construction projects have been authorized for disturbances of one acre or more during this reporting period?

2. How many construction projects disturbing at least one acre were active in your jurisdiction during this reporting period?

3. What percent of active construction sites were inspected during this reporting period? NT %

4. What percent of active construction sites were inspected more than once? NT %

5. Do all inspectors working on behalf of the MS4s contributing to this report use the NYS Construction Stormwater Inspection Manual? Yes No NT

6. Does your MS4/Coalition provide public access to Stormwater Pollution Prevention Plans (SWPPPs) of construction projects that are subject to MS4 review and approval? Yes No NT

If your MS4 is Non-Traditional, are SWPPPs of construction projects made available for public review? Yes No

If Yes, use the following page to identify location(s) where SWPPPs can be accessed.

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

6. con't.:

Submit additional pages as needed.

MS4/Coalition Office

Department

Address

City

Zip

 -

Phone

() -

Library

Address

City

Zip

 -

Phone

() -

Other

Address

City

Zip

 -

Phone

() -

Web Page URL(s): Please provide specific address where SWPPPs can be accessed - not home page.

URL

URL

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

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7. Evaluating Progress Toward Measurable Goals MCM 4

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.**B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.****C. How many times was this observation measured or evaluated in this reporting period?**

--	--	--	--	--

(ex.: samples/participants/events)

D. Has your MS4 made progress toward this measurable goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measure 5. Post-Construction Stormwater Management

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

1. How many and what type of post-construction stormwater management practices has your MS4/Coalition inventoried, inspected and maintained in this reporting period?

	# Inventoried	# Inspections	# Times Maintained
<input type="radio"/> Alternative Practices	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Filter Systems	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Infiltration Basins	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Open Channels	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Ponds	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Wetlands	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> Other	<input type="text"/>	<input type="text"/>	<input type="text"/>

2. Do you use an electronic tool (e.g. GIS, database, spreadsheet) to track post-construction BMPs, inspections and maintenance? Yes No

3. What types of non-structural practices have been used to implement Low Impact Development/Better Site Design/Green Infrastructure principles?

- Building Codes Municipal Comprehensive Plans
- Overlay Districts Open Space Preservation Program
- Zoning Local Law or Ordinance
- None Land Use Regulation/Zoning
- Watershed Plans Other Comprehensive Plan

Other:

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

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SPDES ID

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4a. Are the MS4s contributing to this report involved in a regional/watershed wide planning effort?

Yes No

4b. Does the MS4 have a banking and credit system for stormwater management practices?

Yes No

4c. Do the SWMP Plans for each MS4 contributing to this report include a protocol for evaluation and approval of banking and credit of alternative siting of a stormwater management practice?

Yes No

4d. How many stormwater management practices have been implemented as part of this system in this reporting period?

--	--	--

5. What percent of municipal officials/MS4 staff responsible for program implementation attended training on Low Impace Development (LID), Better Site Design (BSD) and other Green Infrastructure principles in this reporting period?

--	--	--	--

 %

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

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SPDES ID

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6. Evaluating Progress Toward Measurable Goals MCM 5

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.

--

B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.

--

C. How many times was this observation measured or evaluated in this reporting period?

--	--	--	--	--

(ex.: samples/participants/events)

D. Has your MS4 made progress toward this measurable goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

--

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Minimum Control Measure 6. Stormwater Management for Municipal Operations

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

1. Choose/list each municipal operation/facility that contributes or may potentially contribute Pollutants of Concern to the MS4 system. For each operation/facility indicate whether the operation/facility has been addressed in the MS4's/Coalition's Stormwater Management Program(SWMP) Plan and whether a self-assessment has been performed during the reporting period. A self-assessment is performed to: 1) determine the sources of pollutants potentially generated by the permittee's operations and facilities; 2) evaluate the effectiveness of existing programs and 3) identify the municipal operations and facilities that will be addressed by the pollution prevention and good housekeeping program, if it's not done already.

<u>Operation/Activity/Facility</u>	<u>Addressed in SWMP?</u>		<u>Self-Assessment Operation/Activity/Facility performed within the past 3 years?</u>	
	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Yes	<input type="radio"/> No
Street Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bridge Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winter Road Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salt Storage.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solid Waste Management.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New Municipal Construction and Land Disturbance..	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Right of Way Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marine Operations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hydrologic Habitat Modification.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parks and Open Space.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Municipal Building.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stormwater System Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle and Fleet Maintenance.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MS4 Annual Report Form

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Name of MS4/Coalition

SPDES ID

2. Provide the following information about municipal operations good housekeeping programs:

- Parking Lots Swept (Number of acres X Number of times swept) # Acres
 - Streets Swept (Number of miles X Number of times swept) # Miles
 - Catch Basins Inspected and Cleaned Where Necessary #
 - Post Construction Control Stormwater Management Practices Inspected and Cleaned Where Necessary #
 - Phosphorus Applied In Chemical Fertilizer # Lbs.
 - Nitrogen Applied In Chemical Fertilizer # Lbs.
 - Pesticide/Herbicide Applied # Acres .
- (Number of acres to which pesticide/herbicide was applied X Number of times applied to the nearest tenth.)

3. How many stormwater management trainings have been provided to municipal employees during this reporting period?

4. What was the date of the last training? / /

5. How many municipal employees have been trained in this reporting period?

6. What percent of municipal employees in relevant positions and departments receive stormwater management training? %

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

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7. Evaluating Progress Toward Measurable Goals MCM 6

Use this page to report on your progress and project plans toward achieving measurable goals identified in your Stormwater Management Program Plan (SWMPP), including requirements in Part III.C.1. Submit additional pages as needed.

A. Briefly summarize the Measurable Goal identified in the SWMPP in this reporting period.**B. Briefly summarize the observations that indicated the overall effectiveness of this Measurable Goal.****C. How many times was this observation measured or evaluated in this reporting period?**

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(ex.: samples/participants/events)

D. Has your MS4 made progress toward this measurable goal during this reporting period?

Yes No

E. Is your MS4 on schedule to meet the deadline set forth in the SWMPP?

Yes No

F. Briefly summarize the stormwater activities planned to meet the goals of this MCM during the next reporting cycle (including an implementation schedule).

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

SPDES ID

Additional Watershed Improvement Strategy Best Management Practices

The information in this section is being reported (check one):

- On behalf of an individual MS4
- On behalf of a coalition

How many MS4s contributed to this report?

MS4s must answer the questions or check NA as indicated in the table below.

MS4 Description	Answer	Check NA	(POC)
NYC EOH Watershed			
Traditional Land Use	1,2,3,4,5,6,7a-d,8a,8b,9	10,11,12	Phosphorus
Traditional Non-Land Use	1,2,3,4,7a-d,8a,8b,9	5,10,11,12	Phosphorus
Non-Traditional	1,2,77a-d,8a,8b,9	3,4,5,10,11,12	Phosphorus
Onondaga Lake Watershed			
Traditional Land Use	1,6,7a-d,8a,9	2,3,4,5,8b,10,11,12	Phosphorus
Traditional Non-Land Use	1,6,7a-d,8a,9	2,3,4,5,8b,10,11,12	Phosphorus
Non-Traditional	1,6,7a-d,8a,9	2,3,4,5,8b,10,11,12	Phosphorus
Greenwood Lake Watershed			
Traditional Land Use	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
Traditional Non-Land Use	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
Non-Traditional	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
Oyster Bay			
Traditional Land Use	1,4,7a-d,9,10,11,12	2,3,5,6,8a,8b	Pathogens
Traditional Non-Land Use	1,4,7a-d,9,10,11,12	2,3,5,6,8a,8b	Pathogens
Non-Traditional	1,4,7a-d,9	2,3,4,5,8a,8b,10,11,12	Pathogens
Peconic Estuary			
Traditional Land Use	1,4,7a-d,8a,9,10,11,12	2,3,5,6,8b	Pathogens and Nitrogen
Traditional Non-Land Use	1,4,7a-d,8a,9,10,11,12	2,3,5,6,8b	Pathogens and Nitrogen
Non-Traditional	1,4,7a-d,8a,9	2,3,4,5,8b,10,11,12	Pathogens and Nitrogen
Oscawana Lake Watershed			
Traditional Land Use	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
Traditional Non-Land Use	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
Non-Traditional	1,4,6,7a-d,8a,9	2,3,5,8b,10,11,12	Phosphorus
LI 27 Embayments			
Traditional Land Use	1,2,3,4,7a-d,9,10,11,12	5,6,8a,8b	Pathogens
Traditional Non-Land Use	1,2,3,4,7a-d,9,10,11,12	5,6,8a,8b	Pathogens
Non-Traditional	1,2,3,4,7a-d,9	5,6,8a,8b,10,11,12	Pathogens

1. Does your MS4/Coalition have an education program addressing impacts of phosphorus/nitrogen/pathogens on waterbodies? Yes No N/A

2. Has 100% of the MS4/Coalition conveyance system been mapped in GIS? Yes No N/A

If N/A, go to question 3.

If No, estimate what percentage of the conveyance system has been mapped so far. %

Estimate what percentage was mapped in this reporting period. %

MS4 Annual Report Form

This report is being submitted for the reporting period ending March 9,

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If submitting this form as part of a joint report on behalf of a coalition leave SPDES ID blank.

Name of MS4/Coalition

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SPDES ID

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- 9. Has your MS4/Coalition developed and implemented a program of native planting?**
 Yes No N/A
- 10. Has your MS4/Coalition enacted a local law prohibiting pet waste on municipal properties and prohibiting goose feeding?**
 Yes No N/A
- 11. Does your MS4/Coalition have a pet waste bag program?**
 Yes No N/A
- 12. Does your MS4/Coalition have a program to manage goose populations?**
 Yes No N/A

Exhibit 9

Developed Measurable Goals

The goal of the Stormwater Management Procedure Plan (SWMP or Plan) is to set a series of goals intended to improve the management of stormwater. At a minimum, these goals should strive to:

- Reduce flood damage, including damage to life and property;
- Minimize, the impact of stormwater runoff from any new development;
- Reduce soil erosion from any development or construction project;
- Assure the adequacy of existing and proposed culverts, bridges, and other in-stream structures;
- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- Maintain the integrity of stream channels for their biological functions, as well as for drainage;
- Minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state and community; to protect public health; to safeguard fish and aquatic life and scenic and ecological values; and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
- Protect public safety through the proper design and operation of stormwater basins.

Short-Term Measurable Goals

To achieve these objectives, Measurable Goals are established to determine the effectiveness of stormwater management practices. Short-term (yearly) goals are established as part of the annual revisions to the SWMP Plan and are reported in conjunction with the MS4 Annual Report included in Exhibit 8 of the SWMP. A Summary of the Sort-Term Quantitative Measurable Goals for the 2021 SWMP Plan are as follows:

MCM 1: Public Education and Outreach

Measurable Goals:

- Present the revised SWMP Plan and 2021 MS4 Annual Report to the Town Board, Planning Board, and public during live or zoom meetings through the course of at least four public meetings.
- Continue with the development, distribution, and public presentation of Stormwater education materials at Town Board and Planning Board Meetings and posting at Town Offices, with at least four separate brochures created for distribution.
- Post potential Stormwater notices on Town electronic display board as required.
- Develop and populate the Stormwater page on the Town's Website and track the development of postings and comments received.
- Continue the formation of groups and committees for residents to become involved in and help with the education and awareness of Stormwater issues and track community participation.

MCM 2: Public Involvement/Participation*Measurable Goals:*

- Post and facilitate public review of MS4 Annual Report and tabulate collection of comments.
- Post and facilitate public review of SWMP Plan and tabulate collection of comments.
- Increase efforts to have more residents join committees or activities associated with stormwater management issues and work with Town Board and Planning Board to track public involvement.
- Continue to investigate public concerns submitted to Stormwater Management Officer and track e-mails and phone calls related to such.

MCM 3: Illicit Discharge Detection and Elimination*Measurable Goals:*

- Implement the revised IDDE Program and track inspections and mapping as per SWMP Exhibits to get program back on track (30% inspection and mapping of waterbodies).
- Implement the Outfall Mapping (Audit) Program and track inspections and mapping as per SWMP Exhibits to get program back on track (103 outfalls).
- Increase training for relevant Municipal (Field) Staff and track training, with a target of at least two training sessions.
- Review Non-Stormwater Discharge list and update every other year in SWMP Exhibit 18

MCM 4: Construction Site Stormwater Runoff Control*Measurable Goals:*

- Adopt revised Local Law No. 1 ó Stormwater Management and Erosion and Sediment Control.
- Continue to audit SWPPP Review process and revise SWMP Exhibit.
- Improve Town monthly SWPPP inspection procedure and tracking process by updating tracking spreadsheet on a monthly basis and archiving inspections for inclusion in MS4 Report.
- Continue training for relevant Municipal (Field) Staff and track training, with a target of at least two training sessions.

MCM 5: Post-Construction Stormwater Management*Measurable Goals:*

- Continue Post-Construction Stormwater Management Practices Inventory Audit and Continue Post-Construction Stormwater Management Practices

Inventory Audit and update Inventory Tracking Spreadsheet and Mapping to reflect existing and new Stormwater Practices.

- Strengthen Post-Construction Stormwater Management Practices Inspection program and enforcement policy for reporting and track inspections and enforcement documentation.
- Continue training for relevant Municipal (Field) Staff and track training, with a target of at least two training sessions.

MCM 6: Stormwater Management for Municipal Operations

Measurable Goals:

- Increase and document municipal training program and document and track employee training.
- Document municipal operations, BMPs and SOPs that reduce the potential for stormwater impact and catalogue and track updates to BMPs and SOPs

Long-Term Goals

In addition to the quantifiable short-term goals, the Town also seeks to establish long-term qualitative goals with respect the stormwater policy. These goals include:

MCM 1: Public Education and Outreach

Measurable Goals:

- Continue to advance work as a Climate Smart Community.
- Update the Waterbodies of Concern list as required.
- Refine the criteria for Geographic Areas of Concern (GOC) and update GOC mapping.

MCM 2: Public Involvement/Participation

Measurable Goals:

- Continue to form committees that include and encourage members of the community to engage in active education and the potential formation of guidelines or regulations associated with multiple issues, including environmental and stormwater concerns.

MCM 3: Illicit Discharge Detection and Elimination

Measurable Goals:

- Continue to conduct inspections of Town waterbodies for signs of illicit discharges, with a goal of inspecting 20%-25% of waterbodies annually.

- Develop and institute an IDDE Program for Building Department and Highway Department personnel.

MCM 4: Construction Site Stormwater Runoff Control

Measurable Goals:

- Implement a more formal and stringent policy regarding SWPPP enforcement, particularly as related to violations.

MCM 5: Post-Construction Stormwater Management

Measurable Goals:

- Establish municipal code and clearer requirements for the management of post-construction stormwater management practices.
- Limit or minimize the Town's maintenance obligations for post-construction stormwater management practices.

MCM 6: Stormwater Management for Municipal Operations

Measurable Goals:

- Self-assess Best Management Practices (BMPs) for Town Municipal Operations to minimize potential stormwater impacts every three years.

Exhibit 10

SWMP Review and Update Procedures

The Town of North Greenbush's Stormwater Management Plan shall be updated on an annual basis based upon the following general procedure:

- The current New York State Department of Environmental Conservation General Permit shall be verified.
- The SWMP Plan Main Section (Exhibit 0) will be reviewed and updated for the following:
 - Compliance with the current General Permit. Any new requirements or Exhibits necessary to conform with the General Permit shall be added to the SWMP body.
 - BMPs and Reporting Requirements will be updated to align with the Town's Annual MS4 Report.
- Exhibits associated with mapping and field inspections will be reviewed and updated to reflect work completed during the prior year.
- Exhibits with written procedures will be reviewed and updated based upon the observed effectiveness of the various procedures.
- Exhibits with charts, tables and submissions will be updated to reflect current data.
- A draft version of the revised SWMP will be posted on the Town's Stormwater web page for public review and comment and the Stormwater Management Officer will announce that a draft revised SWMP has been posted for review during the Town Board Meeting and Planning Board Meeting following the posting. An e-mail address will be provided to receive public comment.
- After reviewing public comments, the SWMP will be further revised as required based upon pertinent public comments.
- The final revised version of the SWMP will be posted on the Town's Stormwater web page, and announced at the Town Board Meeting and Planning Board Meeting following the posting.
- The updated Exhibit Review Plan will be posted within this Exhibit.

Stormwater Management Program Plan Exhibit Review Plan

Updated 06/01/21

Exhibit	Title	Revision Information				
		Rev No.	Rev Date	By	Rev Title	Status
0	SWMP Plan Main Section	1	06/01/21	EPW	2021 SWMP	Posted
1	Public Presentation: Town of North Greenbush's Stormwater Management Program	1	06/01/21	EPW	2021 SWMP	Posted
2	Pollutants of Concern	0	03/17/21	EPW	2020 SWMP	Posted
3	Spill Response Procedures	0	12/28/20	EPW	2020 SWMP	Posted
4	Current General Permit	0	12/28/20	EPW	2020 SWMP	Posted
5	Waterbodies of Concern	0	03/17/21	EPW	2020 SWMP	Posted
6	Snyders Lake Water Quality and Best Management Practices	0	03/01/21	EPW	2020 SWMP	Posted
7	Geographic Areas of Concern	0	03/26/21	EPW	2020 SWMP	Posted
8	Town of North Greenbush's Annual MS4 Report	1	06/01/21	EPW	2021 SWMP	Posted
9	Developed Measurable Goals	1	06/01/21	EPW	2021 SWMP	Posted
10	SWMP Review and Update Procedures	1	06/01/21	EPW	2021 SWMP	Posted
11	Public Concerns Investigation Procedure	1	06/01/21	EPW	2021 SWMP	Posted
12	Illicit Discharge Detection and Elimination Program	1	06/01/21	EPW	2021 SWMP	Posted
13	Illicit Discharge Detection and Elimination Mapping	0	03/29/21	EPW	2020 SWMP	Posted
14	Outfall Mapping	1	06/01/21	EPW	2021 SWMP	Posted
15	Outfall Inspection and Monitoring Procedures	1	06/01/21	EPW	2021 SWMP	Posted
16	Local Law No. 2 of the Year 2008 Illicit Discharges, Activities and Connections to the Town of North Greenbush's Municipal Separate Storm Sewer System	0	12/28/20	EPW	2020 SWMP	Posted
17	Illicit Discharge Detection and Elimination Public Awareness Program	0	03/29/21	EPW	2020 SWMP	Posted
18	Exempt Non-Stormwater Discharges	0	12/28/20	EPW	2020 SWMP	Posted
19	Local Law No. 1 of the Year 2008: Stormwater Management and Erosion and Sediment Control	0	03/01/21	EPW	2020 SWMP	Posted
20	SWPPP Submission and Review Process	0	03/01/21	EPW	2020 SWMP	Posted
21	SWPPP Pre-Construction Meeting and Training Verification	1	06/01/21	EPW	2021 SWMP	Posted
22	SWPPP Inspection and Enforcement Policy	1	06/01/21	EPW	2021 SWMP	Posted
23	SWPPP Post-Construction Inspection and Project Closure Policy	0	03/01/21	EPW	2020 SWMP	Posted
24	Stormwater Permit Tracking Spreadsheet	1	06/01/21	EPW	2021 SWMP	Posted
25	Post-Construction Stormwater Management Practices Inventory	1	06/01/21	EPW	2021 SWMP	Posted

Stormwater Management Program Plan Exhibit Review Plan

Updated 06/01/21

Exhibit	Title	Revision Information				
		Rev No.	Rev Date	By	Rev Title	Status
26	Post-Construction Stormwater Management Practices Inspection and Enforcement	1	06/01/21	EPW	2021 SWMP	Posted
27	Pollution Prevention and Good Housekeeping for Municipal Operations	1	06/01/21	EPW	2021 SWMP	Posted
28	Highway Department Vehicle and Garage Operation and Maintenance Procedures	0	03/01/21	EPW	2020 SWMP	Posted
29	Highway Garage's Fuel and Petroleum Storage and Use Procedures	0	03/01/21	EPW	2020 SWMP	Posted
30	Highway Garage's Salt Storage and Use Procedures	0	03/01/21	EPW	2020 SWMP	Posted
31	SWMP Annual Budget	1	06/01/21	EPW	2021 SWMP	Posted

Exhibit 11

Public Concerns Investigation Procedure

The Town of North Greenbush Building Department's staff and the Stormwater Management Officer (SMO) have the responsibility to cooperate and collaborate in the course of their normal duties to identify, respond to, and investigate public concerns regarding potential illicit discharges or stormwater discharge violations. The Town has created a Stormwater web page, and has included a section entitled "Stormwater Concerns and Potential Violation Investigation." Within this section is a reference to the contact phone number and e-mail address for the Stormwater Management Officer.

If contacted with a potential stormwater concern or violation, the following procedure shall be used to investigate the matter:

- The SMO shall reach out to the Complainant to further discuss the issue. The identity of the Complainant shall remain confidential.
- The Public Stormwater Concerns Investigation Tracking Spreadsheet will be updated and the Concern given a case number. A file will be created as required.
- The Concern will be investigated by the SMO or a qualified designee. The investigation shall concentrate on the details of the complaint and other pertinent stormwater details. Reference photographs shall be taken, as applicable.
- The SMO will determine the validity of the Concern and will contact the Owner of the property associated with the Concern to discuss the details of the potential violation.
- The SMO will work with the Owner to develop a Remediation Plan to address the Concern. The timeframe to address the Concern will be based upon the severity of the Concern and the potential for harm to the public and the associated waterbody. If necessary, the following resources will be used to meet with the Owner and develop the Remediation Plan:
 - Town of North Greenbush Police Department
 - New York State Department of Environmental Conservation
 - The Environmental Protection Agency or Army Corps of Engineers
- The SMO will memorialize the Remediation Plan in writing and shall provide a copy of the Plan to the Owner via e-mail or certified mail.
- The SMO, Building Department, or qualified designee will verify that the Remediation Plan has been implemented in accordance with the documented scope and schedule. In the event the Owner fails to comply with the Remediation Plan, the following graduated steps shall be taken:
 - Submission of a second written notification to the Owner for non-compliance and the development of a revised Remediation Plan.
 - Issuance of a Stop Work Order for ongoing construction projects.

- Issuance of a Notice of Violation and, potentially, an Appearance Ticket for Code Violations.
 - Criminal proceedings for law violations, if applicable.
 - Notification of violations to NYSDEC or other entities for assistance with enforcement.
-
- The Public Stormwater Concerns Investigation Tracking Spreadsheet will be updated based upon actions taken for the Concern.
 - The Complainant will be notified of the Concern resolution.
 - If applicable, the SMO will conduct future inspections of the subject property to verify continued compliance.

A copy of the Public Stormwater Concerns Investigation Tracking Spreadsheet is included as part of this Exhibit.

Exhibit 12

Illicit Discharge Detection and Elimination Program

The Town is currently developing an Illicit Discharge Detection and Elimination (IDDE) Program based upon the following reference documentation, included in this Exhibit:

- Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments
- Illicit Discharge Detection and Elimination: TECHNICAL APPENDICIES

The Town will employ a series of Best Management Practices (BMPs) that will focus on the detection and elimination of illicit discharges throughout the municipality. The IDDE Program will consist of the following components:

- **Field Inspections.** The Town will conduct field inspections of existing waterways for signs of illicit discharges using the attached IDDE Inspection Form attached to this exhibit. The Town will inspect a minimum of 20% of its waterways each year. As the Town does not currently have an IDDE database, an effort will be made to conduct inspections in a prioritized manner, consistent with the Geographic Areas of Concern outlined in Exhibit 7, as follows:
 - Wynantskill Creek Watershed.
 - The Hudson River Watershed.
 - The Route 4 and Main Avenue corridors.
- **IDDE Equipment.** The Town is in the process of developing its inventory of IDDE equipment associated with the field reconnaissance of outfalls, categorized as follows:

Current Field Inspection Equipment

- Backpack for transporting items
- Cell phone camera for taking pictures (individually owned)
- Hand-held GPS unit to determine outfall coordinates
- Spray paint for marking locations
- Sharpie marker for marking locations
- Tape measure for determining stream or outfall geometry
- Cell phone with second hand for determining flow rates
- Stream thermometer for determining water temperature
- Bottles for securing samples
- Sanitary wipes
- pH testing equipment
- Case-style clip board for securing documents.
- Pencils and markers for taking notes

Required Field Inspection Documentation

- Driver's license or other photo identification
- Field inspection sheets
- Town map

Field Access Clothing and Safety Equipment

- Waders (personally owned/not shared)
- Flash light or head lamp
- First aid kit
- Whistle
- Cell phone for emergency calls (personally owned)
- Hat or hard hat (personally owned)
- Water bottle for hydration (personally owned)
- Reflective vest

Equipment to be Procured or Shared with Other Entities

- Digital temperature probe
- Portable Spectrophotometer and reagents
- Mapping and Tracking. The Town will map illicit discharges and track them on the IDDE Tracking Spreadsheet as discussed in Exhibit 13.
- Determination of Origin. The Town will determine, to the best extent possible, the source of the illicit discharge.
- Notification and Cessation. The Town will notify the originator of the illicit discharge, if possible, and will work with the responsible party to eliminate the illicit discharge. Based upon the response of the originator and the efforts made to remedy the situation, the Town will escalate enforcement options as necessary.
- Verification. The Town will conduct a follow-up inspection of the illicit discharge site to verify that the discharge has been effectively remedied.

As the Town continues to develop and define its IDDE Program, the general format outlined above will be initially employed, with the assistance of and training by the Town Designated Engineer or other qualified consultant, and revisions or expansions to the Program will be made and implemented as experience dictates. The Town anticipates having a more clearly defined IDDE Program developed by the end of the 2021 reporting year, and will work to integrate this program with the Outfall Mapping and Outfall Inspection and Monitoring Procedures outlined in Exhibits 14 and 15.

Town of North Greenbush IDDE Inspection Form

General IDDE Data

IDDE ID:	Location:	New?
Inspector:	Date:	Time:
Temp:	Rainfall inches in: Last 24 Hours	Last 48 Hours
Latitude:	Longitude:	As Mapped?
Photos:	Logged:	
Drainage Area Land Use (Select all that apply) <input type="checkbox"/> Industrial <input type="checkbox"/> Open Space <input type="checkbox"/> Urban Residential <input type="checkbox"/> Suburban Residential <input type="checkbox"/> Institutional <input type="checkbox"/> Commercial <input type="checkbox"/> Other: _____ Notes: _____ _____		Maintenance Priority <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low Notes: _____ _____ _____

IDDE Characteristics

<input type="checkbox"/> Closed Pipe Material <input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____ Shape and Configuration <input type="checkbox"/> Circular <input type="checkbox"/> Elliptical <input type="checkbox"/> Box <input type="checkbox"/> Other: _____ Diameter/Dimensions: _____ <input type="checkbox"/> Single <input type="checkbox"/> Double <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____ Supplemental Dim's: _____ Submergence In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open Drainage Material <input type="checkbox"/> Concrete <input type="checkbox"/> Earth <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Other: _____ Shape and Configuration <input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____ Depth: _____ Top Width: _____ Bottom Width: _____ Other: _____ Flow Present? <input type="checkbox"/> Yes <input type="checkbox"/> No Flow Description (if applicable): <input type="checkbox"/> Trickle: <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial
Notes: _____ _____ _____

Town of North Greenbush IDDE Inspection Form

IDDE Characteristics

Flow Rate By Known Volume

Container Volume: _____ Time to Fill: _____ Calculated Flow Rate: _____

Flow Rate By Measured Flow Geometry

Flow Depth: _____ Flow Width: _____ Calculated Flow Volume: _____

Measured Length of Travel: _____ Time of Travel : _____ Calculated Flow Rate: _____

Temperature: _____ pH: _____ Ammonia: _____

Odor

Sewage Rancid/sour Petroleum
 Sulfide Other: _____

Faint Easily Detected Detected From Afar

Color

Clear Brown Gray Yellow
 Green Orange Red Other

Sample in Bottle

Outfall Flow

Faint Easily Detected

Visible in Flow

Turbidity

Slight cloudiness Cloudy Opaque Other: _____

Floatables

Sewage (Toilet Paper) Suds/Froth
 Petroleum (Sheen) Other

Few (origin unknown) Some (indic. of origin)
 Some (origin clear)

Notes: _____

Physical Indicators/Characteristics Not Related to Flow

IDDE Damage

Spalling/Cracking Peeling Paint
 Corrosion Other

Comments:

Desposits /
Stains

Oily Flow Line
 Paint Other

Comments:

Abnormal
Vegetation

Excessive Inhibited
 Other

Comments:

Poor Pool
Quality

Odors Colors Floatables
 Sheen Suds Excessive Algae

Comments:

Pipe Benthic
Growth

Brown Orange
 Green Other

Comments:

Notes: _____

Town of North Greenbush IDDE Inspection Form

Sample Data Collection

Has a sample been collected for lab analysis? Yes No

If yes, from where was the sample taken? Flow Pool

Has an intermittent flow trap set? Yes No Type: _____

Notes: _____

Other

Is the structure to be characterized as an outfall or IDDE?

Unlikely Potential (two or more indicators) Suspect (one or more severe indicators) Obvious

Notes: _____

Are there any non-illicit discharge concerns (trash, required repairs, etc)?

Notes: _____

What are the illicit discharge concerns?

Notes: _____

Other general comments

Notes: _____



Illicit Discharge Detection and Elimination

*A Guidance Manual for
Program Development and Technical Assessments*

by the
Center for
Watershed Protection

and
Robert Pitt
University of Alabama

October 2004

Notice

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Illicit Discharge Detection and Elimination

A Guidance Manual for Program Development and Technical Assessments

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Figure Number	Source
2	Snohomish County, WA
4	Fort Worth Department of Environmental Management (DEM)
5	Fort Worth DEM
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16.	Fort Worth DEM
18.	Horsley Whitten
28 (fire hydrant)	Fort Worth DEM
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34 (industrial discharge)	Dr. Robert Pitt
34 (paint)	Dr. Robert Pitt
34 (Toronto industrial spill).	Dr. Robert Pitt
34 (blood)	Fort Worth DEM
34 (failing septic).	Snohomish County, WA
34 (construction site).	Don Green, Franklin, TN
34 (discharge of rinse water).	Rachel Calabro
35 (natural foam).	Snohomish County, WA
35 (high severity suds).	Fort Worth DEM
35 (moderate severity oil)	R. Frymire
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38 (bright red bacteria).	R. Frymire
38 (Sporalitis filamentous)	Robert Ressler, City of Arlington, TX
38 (extreme algal growth)	Mark Sommerfield, Montgomery Co., Maryland
38 (brownish algae)	R. Frymire
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Foreword

A number of past projects have found that dry-weather flows discharging from storm drainage systems can contribute significant pollutant loadings to receiving waters. If these loadings are ignored (by only considering wet-weather stormwater runoff, for example), little improvement in receiving water conditions may occur. Illicit dry-weather flows originate from many sources. The most important sources typically include sanitary wastewater or industrial and commercial pollutant entries, failing septic tank systems, and vehicle maintenance activities.

Provisions of the Clean Water Act (1987) require National Pollutant Discharge Elimination System (NPDES) permits for storm water discharges. Section 402 (p)(3)(B)(ii) requires that permits for municipal separate storm sewers shall include a requirement to effectively prohibit problematic non-storm water discharges into storm sewers. Emphasis is placed on the elimination of inappropriate connections to urban storm drains. This requires affected agencies to identify and locate sources of non-storm water discharges into storm drains so they may institute appropriate actions for their elimination.

This Manual is intended to provide support and guidance, primarily to Phase II NPDES MS4 communities, for the establishment of Illicit Discharge Detection and Elimination (IDDE) programs and the design and procedures of local investigations of non-

storm water entries into storm drainage systems. It also has application for Phase I communities looking to modify existing programs and community groups such as watershed organizations that are interested in providing reconnaissance and public awareness services to communities as part of watershed restoration activities.

This Manual was submitted in partial fulfillment of cooperative agreement X-82907801-0 under the sponsorship of the U.S. Environmental Protection Agency. This report covers a period from July 2001 to July 2004 and was prepared by the Center for Watershed Protection, Ellicott City, MD in cooperation with Robert Pitt of the University of Alabama.

Some references in the document pertain to work conducted during this project. This internal support information was developed as work tasks were completed and research findings were developed. In some cases, memoranda or technical support documents were prepared. Most of these documents are in “draft” form and have not been published. As a result, they should be considered supplemental and preliminary information that is not intended for widespread citation or distribution. In the References section, these documents are identified as “IDDE project support material” at the end of each citation. Interested readers can access these documents through the website link to the project archive and support information.

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Introduction

An up-to-date and comprehensive manual on techniques to detect and correct discharges in municipal storm drains has been unavailable until now. This has been a major obstacle for both Phase I and Phase II National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) communities that must have programs in place that detect, eliminate, and prevent illicit discharges to the storm drain system. Smaller Phase II communities, in particular, need simple but effective program guidance to comply with permits issued by the Environmental Protection Agency (EPA) and states. This manual provides communities with guidance on establishing and implementing an effective Illicit Discharge Detection and Elimination (IDDE) program.

Studies have shown that dry weather flows from the storm drain system may contribute a larger annual discharge mass for some pollutants than wet weather storm water flows (EPA, 1983 and Duke, 1997). Detecting and eliminating these illicit discharges involves complex detective work, which makes it hard to establish a rigid prescription to “hunt down” and correct all illicit connections. Frequently, there is no single approach to take, but rather a variety of ways to get from detection to elimination. Local knowledge and available resources can play significant roles in determining which path to take. At the very least, communities need to systematically understand and characterize their stream, conveyance, and storm sewer infrastructure systems. When illicit discharges are identified, they need to be removed. The process is ongoing

and the effectiveness of a program should improve with time. In fact, well-coordinated IDDE programs can benefit from and contribute to other community-wide water resources-based programs, such as public education, storm water management, stream restoration, and pollution prevention.

This manual incorporates the experience of more than 20 Phase I communities that were surveyed about their practices, levels of program effort, and lessons learned (CWP, 2002). These communities took many different approaches to solve the IDDE problem, and provided great insights on common obstacles, setting realistic expectations and getting a hard job done right. Many of the IDDE methods presented in this manual were first developed and tested in many Phase I communities. Specific techniques applied in a community should be adapted to local conditions, such as dominant discharge types, land use, and generating sites.

Designed with a broad audience in mind, including agency heads, program managers, field technicians and water quality analysts, this manual is primarily focused on providing the thousands of Phase II communities that are now in the process of developing IDDE programs with guidance for the development and implementation of their own programs. The manual has been organized to address the broad range of administrative and technical considerations involved with setting up an effective IDDE program. The first 10 chapters of the Manual focus on “big picture” considerations needed to successfully get an IDDE program off

the ground. The final four chapters provide detailed technical information on the methods to screen, characterize and remove illicit discharges in MS4 communities. These chapters present the state-of-the-practice on specific monitoring techniques and protocols.

In general, the content of this manual gets progressively more complex and technical toward the end. The basic organization of the manual is outlined below. The information is provided to help:

- Define important terminology and understand key illicit discharge concepts
- Conduct an audit to understand community needs and capabilities
- Establish adequate legal authority
- Develop a tracking system to map outfalls and document reported illicit discharges
- Conduct desktop analyses to prioritize targets for illicit discharge control
- Conduct rapid reconnaissance of the stream corridor to find problem outfalls
- Apply new analytical and field methods to find and fix illicit discharges
- Educate municipal employees and the public to prevent discharges
- Estimate costs to run a program and conduct specific investigations

Chapter 1. The Basics of Illicit Discharges–

The many different sources and generating sites that can produce illicit discharges are described in Chapter 1. The chapter also outlines key concepts and terminology needed to understand illicit discharges, why they cause water quality problems and the regulatory context for managing them.

Chapter 2. Components of an Effective Illicit Discharge Program– This chapter presents an overall framework to build an IDDE program, by outlining eight key components of good programs. Each of the following eight chapters is dedicated to a key program component. The first page of the program component chapters is notated with a puzzle icon labeled with the applicable program component number.

Chapter 3. Audit Existing Resources and Programs– This chapter provides guidance on evaluating existing resources, regulations, and ongoing activities in your community to better address illicit discharges.

Chapter 4. Establish Responsibility, Authority and Tracking– This chapter presents guidance on how to identify the local agency who will be responsible for administering the IDDE program, and how to establish the legal authority to control illicit discharges by adapting an existing ordinance or adopting a new one. The chapter also describes how to set up a program tracking system needed to document discharges and local actions to respond to them.

Chapter 5. Desktop Assessment of Illicit Discharge Potential– The fifth chapter describes desktop analyses to process available mapping data to quickly characterize and screen illicit discharge problems at the community and subwatershed scale. Key factors include water quality, land use, development age, sewer infrastructure and outfall density. Rapid screening techniques are presented to define where to begin searching for illicit discharge problems in your community.

Chapter 6. Developing Program Goals and Implementation Strategies–

Communities are required to establish and track measurable goals for their IDDE program under the NPDES MS4 permit program. This chapter recommends a series of potential program goals that can guide local efforts, as well as guidance on how to measure and track progress toward their achievement.

Chapter 7. Searching for Illicit Discharge Problems in the Field– This chapter briefly summarizes the major monitoring techniques to find illicit discharges, and discusses how to select the right combination of monitoring methods to incorporate into your local program.

Chapter 8. Isolating and Fixing Individual Illicit Discharges– The methods used to find and remove illicit discharges are briefly described in this chapter and include citizen hotlines and techniques to trace, locate and remove illicit discharge sources.

Chapter 9. Preventing Illicit Discharges– Prevention is a cost effective way to reduce pollution from illicit discharge. This chapter highlights a series of carrot and stick strategies to prevent illicit discharges.

Chapter 10. IDDE Program Evaluation– IDDE programs must continually evolve to changing local conditions. This chapter describes how to review and revisit program goals to determine if they are being met and to make any needed adjustments.

Chapter 11. The Outfall Reconnaissance Inventory (ORI)– The chapter presents detailed protocols to conduct rapid field screening of problem outfalls. The chapter also outlines the staff and equipment costs needed to conduct an ORI, and presents methods to organize, manage and interpret the data you collect.

Chapter 12. Chemical Monitoring– This chapter presents detailed guidance on the wide range of chemical monitoring options that can be used to identify the composition of illicit discharge flows. The chapter begins by describing different chemical indicators that have been used to identify illicit discharges, and presents guidance on how to collect samples for analysis. The chapter recommends a flow chart approach that utilizes four chemical indicators to distinguish the flow type. The chapter provides specific information on other analytical methods that can be used, as well as proper safety, handling, and disposal procedures. Simple and more sophisticated methods for interpreting monitoring data are discussed, along with comparative cost information.

Chapter 13. Tracking Discharges to Their Source– This chapter describes how to investigate storm drain systems to narrow and remove individual illicit discharges. These techniques include “trunk” investigations (e.g., video surveillance, damming, and infiltration and inflow studies) and on-site investigations (e.g., dye tests, smoke tests, and pollution prevention surveys). The pros and cons of each investigation technique are discussed, and comparative cost estimates are given.

Chapter 14. Techniques to Fix Discharges– This chapter provides tips on the best methods to repair or eliminate discharges. Specific advice is presented on how to identify responsible parties, develop pre-approved subcontractor lists, and estimate unit costs for typical repairs.

Appendices– Eleven technical appendices are provided at the end of the manual.

Chapter 1: The Basics of Illicit Discharges

An understanding of the nature of illicit discharges in urban watersheds is essential to find, fix and prevent them. This chapter begins by defining the terms used to describe illicit discharges, and then reviews the water quality problems they cause. Next, the chapter presents the regulatory context for controlling illicit discharges, and reviews the experience local communities have gained in detecting and eliminating them.

1.1 Important Terminology and Key Concepts

This Manual uses several important terms throughout the text that merit upfront explanation. This section defines the terminology to help program managers perform important illicit discharge detective work in their communities. Key concepts are presented to classify illicit discharges, generating sites and control techniques.

Illicit Discharge

The term “illicit discharge” has many meanings in regulation¹ and practice, but we use a four-part definition in this manual.

1. Illicit discharges are defined as a storm drain that has measurable flow during dry weather containing pollutants and/or pathogens. A storm drain with measurable flow but containing no pollutants is simply considered a discharge.

2. Each illicit discharge has a unique frequency, composition and mode of entry in the storm drain system.
3. Illicit discharges are frequently caused when the sewage disposal system interacts with the storm drain system. A variety of monitoring techniques is used to locate and eliminate illegal sewage connections. These techniques trace sewage flows from the stream or outfall, and go back up the pipes or conveyances to reach the problem connection.
4. Illicit discharges of other pollutants are produced from specific source areas and operations known as “generating sites.” Knowledge about these generating sites can be helpful to locate and prevent non-sewage illicit discharges. Depending on the regulatory status of specific “generating sites,” education, enforcement and other pollution prevention techniques can be used to manage this class of illicit discharges.

Communities need to define illicit discharges as part of an illicit discharge ordinance. Some non-storm water discharges to the MS4 may be allowable, such as discharges resulting from fire fighting activities and air conditioning condensate. Chapter 4 provides more detail on ordinance development.

¹40 CFR 122.26(b)(2) defines an illicit discharge as any discharge to an MS4 that is not composed entirely of storm water, except allowable discharges pursuant to an NPDES permit, including those resulting from fire fighting activities.

Storm Drain

A **storm drain** can be either an *enclosed pipe or an open channel*. From a regulatory standpoint, **major** storm drains are defined as enclosed storm drain pipes with a diameter of 36 inches, or greater or open channels that drain more than 50 acres. For industrial land uses, major drains are defined as enclosed storm drain pipes 12 inches or greater in diameter and open channels that drain more than two acres. **Minor** storm drains are smaller than these thresholds. Both major and minor storm drains can be a source of illicit discharges, and both merit investigation.

Some “pipes” found in urban areas may look like storm drains but actually serve other purposes. Examples include foundation drains, weep holes, culverts, etc. These pipes are generally not considered storm drains from a regulatory or practical standpoint. Small diameter “straight pipes,” however, are a common source of illicit discharges in many communities and should be investigated to determine if they are a pollutant source.

Not all dry weather storm drain flow contains pollutants or pathogens. Indeed, many communities find that storm drains with dry weather flow are, in fact, relatively clean. Flow in these drains may be derived from springs, groundwater seepage, or leaks from water distribution pipes. Consequently, field testing and/or water quality sampling are needed to confirm whether pollutants are actually present in dry weather flow, in order to classify them as an illicit discharge.

Discharge Frequency

The **frequency** of dry weather discharges in storm drains is important, and can be classified as *continuous, intermittent or transitory*.

Continuous discharges occur most or all of the time, are usually easier to detect, and typically produce the greatest pollutant load. **Intermittent** discharges occur over a shorter period of time (e.g., a few hours per day or a few days per year). Because they are infrequent, intermittent discharges are hard to detect, but can still represent a serious water quality problem, depending on their flow type. **Transitory** discharges occur rarely, usually in response to a singular event such as an industrial spill, ruptured tank, sewer break, transport accident or illegal dumping episode. These discharges are extremely hard to detect with routine monitoring, but under the right conditions, can exert severe water quality problems on downstream receiving waters.

Discharge Flow Types

Dry weather discharges are composed of one or more possible **flow types**:

- *Sewage and septage* flows are produced from sewer pipes and septic systems.
- *Washwater* flows are generated from a wide variety of activities and operations. Examples include discharges of gray water (laundry) from homes, commercial carwash wastewater, fleet washing, commercial laundry wastewater, and floor washing to shop drains.
- *Liquid wastes* refers to a wide variety of flows, such as oil, paint, and process water (radiator flushing water, plating bath wastewater, etc.) that enter the storm drain system.
- *Tap water* flows are derived from leaks and losses that occur during the distribution of drinking water in the water supply system. Tap water discharges in the storm drain system may be more prevalent in communities

with high loss rates (i.e., greater than 15%) in their potable water distribution system. (source of 15% is from National Drinking Water Clearinghouse http://www.nesc.wvu.edu/ndwc/articles/OT/FA02/Economics_Water.html)

- *Landscape irrigation* flows occur when excess potable water used for residential or commercial irrigation ends up in the storm drain system.
- *Groundwater and spring water* flows occur when the local water table rises above the bottom elevation of the storm drain (known as the invert) and enters the storm drain either through cracks and joints, or where open channels or pipes associated with the MS4 may intercept seeps and springs.

Water quality testing is used to conclusively identify flow types found in storm drains. Testing can distinguish illicit flow types (sewage/septage, washwater and liquid wastes) from cleaner discharges (tap water, landscape irrigation and ground water).

Each flow type has a distinct chemical fingerprint. Table 1 compares the pollutant fingerprint for different flow types in Alabama. The chemical fingerprint for each flow type can differ regionally, so it is a good idea to develop your own “fingerprint” library by sampling each local flow type.

In practice, many storm drain discharges represent a blend of several flow types, particularly at larger outfalls that drain larger catchments. For example, groundwater flows often dilute sewage thereby masking its presence. Chapter 12 presents several techniques to help isolate illicit discharges that are blended with cleaner discharges. Illicit discharges are also masked by high volumes of storm water runoff making it

difficult and frequently impossible to detect them during wet weather periods.

Mode of Entry

Illicit discharges can be further classified based on how they enter the storm drain system. The **mode of entry** can either be **direct** or **indirect**. **Direct entry** means that the discharge is directly connected to the storm drain pipe through a sewage pipe, shop drain, or other kind of pipe. Direct entry usually produces discharges that are continuous or intermittent. Direct entry usually occurs when two different kinds of “plumbing” are improperly connected. The three main situations where this occurs are:

Sewage cross-connections: A sewer pipe that is improperly connected to the storm drain system produces a continuous discharge of raw sewage to the pipe (Figure 1). Sewage cross-connections can occur in catchments where combined sewers or septic systems are converted to a separate sewer system, and a few pipes get “crossed.”

Straight pipe: This term refers to relatively small diameter pipes that intentionally bypass the sanitary connection or septic drain fields, producing a direct discharge into open channels or streams as shown in Figure 2.

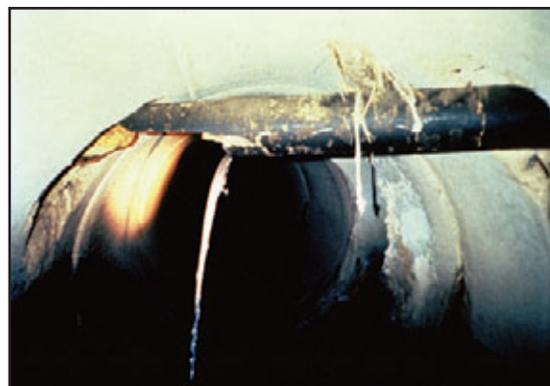


Figure 1: Sewer Pipe Discharging to the Storm Drain System

Table 1: Comparative “Fingerprint” (Mean Values) of Flow Types						
Flow Type	Hardness (mg/L as CaCO ₃)	NH ₃ (mg/L)	Potassium (mg/L)	Conductivity (µS/cm)	Fluoride (mg/L)	Detergents (mg/L)
Sewage	50 (0.26)*	25 (0.53)*	12 (0.21)*	1215 (0.45)*	0.7 (0.1)*	9.7 (0.17)*
Septage**	57(0.36)	87 (0.4)	19 (0.42)	502 (0.42)	0.93 (0.39)	3.3 (1.33)
Laundry Washwater	45 (0.33)	3.2 (0.89)	6.5 (0.78)	463.5 (0.88)	0.85 (0.4)	758 (0.27)
Car Washwater	71 (0.27)	0.9 (1.4)	3.6 (0.67)	274 (0.45)	1.2 (1.56)	140 (0.2)
Plating Bath (Liquid Industrial Waste**)	1430 (0.32)	66 (0.66)	1009 (1.24)	10352 (0.45)	5.1 (0.47)	6.8 (0.68)
Radiator Flushing (Liquid Industrial Waste**)	5.6 (1.88)	26 (0.89)	2801 (0.13)	3280 (0.21)	149 (0.16)	15 (0.11)
Tap Water	52 (0.27)	<0.06 (0.55)	1.3 (0.37)	140 (0.07)	0.94 (0.07)	0 (NA)
Groundwater	38 (0.19)	0.06 (1.35)	3.1 (0.55)	149 (0.24)	0.13 (0.93)	0 (NA)
Landscape Irrigation	53 (0.13)	1.3 (1.12)	5.6 (0.5)	180 (0.1)	0.61 (0.35)	0 (NA)

* The number in parentheses after each concentration is the Coefficient of Variation; NA = Not Applicable
 ** All values are from Tuscaloosa, AL monitoring except liquid wastes and septage, which are from Birmingham, AL.
 Sources: Pitt (project support material) and Pitt et al. (1993)



Figure 2: Direct Discharge from a Straight Pipe

Industrial and commercial cross-connections: These occur when a drain pipe is improperly connected to the storm drain system producing a discharge of wash water, process water or other inappropriate flows into the storm drain pipe. A floor shop drain that is illicitly connected to the storm drain system is illustrated in Figure 3.

Sewage has the greatest potential to produce *direct* illicit discharges within any urban subwatershed, regardless of the diverse land uses that it comprises. The most commonly reported sewage-related direct discharges are broken sanitary sewer lines (81% of survey respondents), cross-connections (71% of survey respondents), and straight pipe discharges (38% of survey respondents). (CWP, 2002).

Older industrial areas tend to have a higher potential for illicit cross-connections.

Indirect entry means that flows generated outside the storm drain system enter through storm drain inlets or by infiltrating through the joints of the pipe. Generally, indirect modes of entry produce intermittent or transitory discharges, with the exception of groundwater seepage. The five main modes of indirect entry for discharges include:

Groundwater seepage into the storm drain pipe: Seepage frequently occurs in storm

drains after long periods of above average rainfall. Seepage discharges can be either continuous or intermittent, depending on the depth of the water table and the season. Groundwater seepage usually consists of relatively clean water that is not an illicit discharge by itself, but can mask other illicit discharges. If storm drains are located close to sanitary sewers, groundwater seepage may intermingle with diluted sewage.

Spills that enter the storm drain system at an inlet: These transitory discharges occur when a spill travels across an impervious surface and enters a storm drain inlet. Spills can occur at many industrial, commercial and transport-related sites. A very common example is an oil or gas spill from an accident that then travels across the road and into the storm drain system (Figure 4).

Dumping a liquid into a storm drain inlet: This type of transitory discharge is created when liquid wastes such as oil, grease, paint, solvents, and various automotive fluids are dumped into the storm drain (Figure 5). Liquid dumping occurs intermittently at sites that improperly dispose of rinse water and wash water during maintenance and

cleanup operations. A common example is cleaning deep fryers in the parking lot of fast food operations.

Outdoor washing activities that create flow to a storm drain inlet: Outdoor washing may or may not be an illicit discharge, depending on the nature of the generating site that produces the wash water. For example, hosing off individual sidewalks and driveways may not generate significant flows or pollutant loads. On the other hand, routine washing of fueling areas, outdoor storage areas, and parking lots (power washing), and construction equipment cleanouts may result in unacceptable pollutant loads (Figure 6).

Non-target irrigation from landscaping or lawns that reaches the storm drain system: Irrigation can produce intermittent discharges from over-watering or misdirected sprinklers that send tap water over impervious areas (Figure 7). In some instances, non-target irrigation can produce unacceptable loads of nutrients, organic matter or pesticides. The most common example is a discharge from commercial landscaping areas adjacent to parking lots connected to the storm drain system.



Figure 3: A common industrial cross connection is a floor drain that is illicitly connected to a storm drain



Figure 4: Accident spills are significant sources of illicit discharges to the storm drain system



Figure 5: Dumping at a storm drain inlet



Figure 6: Routine outdoor washing and rinsing can cause illicit discharges



Figure 7: Non-target landscaping irrigation water

Land Use and Potential Generating Sites

Land use can predict the potential for indirect discharges, which are often intermittent or transitory. Many indirect discharges can be identified and prevented using the concept of “generating sites,” which are sites where common operations can generate indirect discharges in a community. Both research and program experience indicate that a small subset of generating sites within a broader land use category can produce most of the indirect

discharges. Consequently, the density of potential generating sites within a subwatershed may be a good indicator of the severity of local illicit discharge problems. Some common generating sites within major land use categories are listed in Table 2, and described below.

Residential Generating Sites: Failing septic systems were the most common residential discharge reported in 33% of IDDE programs surveyed (CWP, 2002). In addition, indirect residential discharges were

also frequently detected in 20% of the IDDE programs surveyed, which consisted of oil dumping, irrigation overflows, swimming pool discharges, and car washing. Many indirect discharges are caused by common residential behaviors and may not be classified as “illicit” even though they can contribute to water quality problems. With the exception of failing septic systems and oil dumping, most communities have chosen education rather than enforcement as the primary tool to prevent illicit discharges from residential areas.

Commercial Generating Sites: Illicit discharges from commercial sites were reported as frequent in almost 20% of local IDDE programs surveyed (CWP, 2002).

Typical commercial discharge generators included operations such as outdoor washing; disposal of food wastes; car fueling, repair, and washing; parking lot power washing; and poor dumpster management. Recreational areas, such as marinas and campgrounds, were also reported to be a notable source of sewage discharges. It is important to note that not all businesses within a generating category actually produce illicit discharges; generally only a relatively small fraction do. Consequently, on-site inspections of individual businesses are needed to confirm whether a property is actually a generating site.

Sewage can also be linked to significant *indirect* illicit discharges in the form of sanitary sewer overflows (52% of survey respondents), sewage infiltration/inflow (48% of survey respondents), and sewage dumping from recreational vehicles (33% of survey respondents) (CWP, 2002).

Table 2: Land Uses, Generating Sites and Activities That Produce Indirect Discharges		
Land Use	Generating Site	Activity that Produces Discharge
Residential	<ul style="list-style-type: none"> • Apartments • Multi-family • Single Family Detached 	<ul style="list-style-type: none"> • Car Washing • Driveway Cleaning • Dumping/Spills (e.g., leaf litter and RV/boat holding tank effluent) • Equipment Washdowns • Lawn/Landscape Watering • Septic System Maintenance • Swimming Pool Discharges
Commercial	<ul style="list-style-type: none"> • Campgrounds/RV parks • Car Dealers/Rental Car Companies • Car Washes • Commercial Laundry/Dry Cleaning • Gas Stations/Auto Repair Shops • Marinas • Nurseries and Garden Centers • Oil Change Shops • Restaurants • Swimming Pools 	<ul style="list-style-type: none"> • Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing • Washdown of greasy equipment and grease traps
Industrial	<ul style="list-style-type: none"> • Auto recyclers • Beverages and brewing • Construction vehicle washouts • Distribution centers • Food processing • Garbage truck washouts • Marinas, boat building and repair • Metal plating operations • Paper and wood products • Petroleum storage and refining • Printing 	<ul style="list-style-type: none"> • All commercial activities • Industrial process water or rinse water • Loading and un-loading area washdowns • Outdoor material storage (fluids)
Institutional	<ul style="list-style-type: none"> • Cemeteries • Churches • Corporate Campuses • Hospitals • Schools and Universities 	<ul style="list-style-type: none"> • Building Maintenance (e.g., power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Parking Lot Maintenance (power washing) • Vehicle Washing
Municipal	<ul style="list-style-type: none"> • Airports • Landfills • Maintenance Depots • Municipal Fleet Storage Areas • Ports • Public Works Yards • Streets and Highways 	<ul style="list-style-type: none"> • Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Road Maintenance • Spill Prevention/Response • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing

Industrial Generating Sites: Industrial sites produce a wide range of flows that can cause illicit discharges. The most common continuous discharges are operations involving the disposal of rinse water, process water, wash water and contaminated, non-contact cooling water. Spills and leaks, ruptured pipes, and leaking underground storage tanks are also a source of indirect discharges. Illicit discharges from industry were detected in nearly 25% of the local IDDE programs surveyed (CWP, 2002).

Industries are classified according to hundreds of different Standard Industrial Classification (SIC) codes. The SIC coding system also includes commercial, institutional and municipal operations². Many industries are required to have storm water pollution prevention and spill response plans under EPA's Industrial Storm Water NPDES Permit Program. A complete list of the industries covered by the Storm Water NPDES Permit Program can be found in Appendix A. The appendix also rates each industrial category based on its potential to produce illicit discharges, based on analysis by Pitt (2001).

Institutional Generating Sites: Institutions such as hospitals, corporate campuses, colleges, churches, and cemeteries can be generating sites if routine maintenance practices/operations create discharges from parking lots and other areas. Many large institutional sites have their own areas for fleet maintenance, fueling, outdoor storage, and loading/unloading that can produce indirect discharges.

Municipal Generating Sites: Municipal generating sites include operations that handle solid waste, water, wastewater, street and storm drain maintenance, fleet washing, and yard waste disposal. Transport-related areas such as streets and highways, airports, rail yards, and ports can also generate indirect discharges from spills, accidents and dumping.

Finding, Fixing, and Preventing Illicit Discharges

The purpose of an IDDE program is to find, fix and prevent illicit discharges, and a series of techniques exist to meet these objectives. The remainder of the manual describes the major tools used to build a local IDDE program, but they are briefly introduced below:

Finding Illicit Discharges

The highest priority in most programs is to find any continuous and intermittent sewage discharges to the storm drain system. A range of monitoring techniques can be used to find sewage discharges. In general, monitoring techniques are used to find problem areas and then trace the problem back up the stream or pipe to identify the ultimate generating site or connection. Monitoring can sometimes pick up other types of illicit discharge that occur on a continuous or intermittent basis (e.g., wash water and liquid wastes). Monitoring techniques are classified into three major groups:

- Outfall Reconnaissance Inventory
- Indicator Monitoring at Storm Water Outfalls and In-stream
- Tracking Discharges to their Source

²More recently, federal agencies including EPA, have adopted the North American Industry Classification System (NAICS, pronounced "Nakes") as the industry classification system. For more information on the NAICS and how it correlates with SIC, visit <http://www.census.gov/epcd/www/naics.html>.

!!! Caution !!!

Using land use as an indicator for certain flow types such as sewage is often less reliable than other factors in predicting the potential severity of sewage discharges. More useful assessment factors for illicit sewage discharges include the age of the sewer system, which helps define the physical integrity and capacity of the pipe network, as well as age of development, which reveals the plumbing codes and practices that existed when individual connections were made over time. Two particular critical phases in the sewer history of a subwatershed are when sanitary sewers were extended to replace existing septic systems, or when a combined sewer was separated. The large number of new connections and/or disconnections during these phases increases the probability of bad plumbing.

Fixing Illicit Discharges

Once sewage discharges or other connections are discovered, they can be fixed, repaired or eliminated through several different mechanisms. Communities should establish targeted education programs along with legal authority to promote timely corrections. A combination of carrots and sticks should be available to deal with the diversity of potential dischargers.

Preventing Illicit Discharges

The old adage “an ounce of prevention is worth a pound of cure” certainly applies to illicit discharges. Transitory discharges from generating sites can be minimized through pollution prevention practices and well-executed spill management and response plans. These plans should be frequently practiced by local emergency response agencies and/or trained workers at generating sites. Other pollution prevention practices are described in Chapter 9 and explored in greater detail in Manual 8 of the Urban Subwatershed Restoration Manual Series (Schueler *et al.*, 2004).

National Urban Runoff Project

EPA's National Urban Runoff Project (NURP) studies highlighted the significance of pollutants from illicit entries into urban storm sewerage (EPA, 1983). Such entries may be evidenced by flow from storm sewer outfalls following substantial dry periods. Such flow, frequently referred to as “baseflow” or “dry weather flow”, could be the result of direct “illicit connections” as mentioned in the NURP final report (EPA, 1983), or could result from indirect connections (such as leaky sanitary sewer contributions through infiltration). Many of these dry weather flows are continuous and would therefore occur during rain induced runoff periods. Pollutant contributions from dry weather flows in some storm drains have been shown to be high enough to significantly degrade water quality because of their substantial contributions to the annual mass pollutant loadings to receiving waters (project research).

1.2 The Importance of Illicit Discharges in Urban Water Quality

Dry and wet weather flows have been monitored during several urban runoff studies. These studies have found that discharges observed at outfalls during dry weather were significantly different from wet weather discharges. Data collected during the 1984 Toronto Area Watershed Management Strategy Study monitored and characterized both storm water flows and baseflows (Pitt and McLean, 1986). This project involved intensive monitoring in two test areas (a mixed residential/commercial area and an industrial area) during warm, cold, wet, and dry weather. The annual mass discharges of many pollutants were found to be greater in dry weather flows than in wet weather flows.

A California urban discharge study identified commercial and residential discharges of oil and other automobile-related fluids as a common problem based on visual observations (Montoya, 1987). In another study, visual inspection of storm water pipes discharging to the Rideau River in Ontario found leakage from sanitary sewer joints or broken pipes to be a major source of storm drain contamination (Pitt, 1983).

Several urban communities conducted studies to identify and correct illicit connections to their storm drain systems during the mid-1980s. These studies were usually taken in response to receiving water quality problems or as part of individual NURP research projects. The studies indicated the magnitude and extent of cross-connection problems in many urban watersheds. For example, Washtenaw County, Michigan tested businesses to locate direct illicit connections to the county storm

drain system. Of the 160 businesses tested, 38% were found to have illicit storm drain connections (Schmidt and Spencer, 1986). An investigation of the separate storm sewer system in Toronto, Ontario revealed 59% of outfalls had dry weather flows, while 14% of the total outfalls were characterized as “grossly polluted,” based on a battery of chemical tests (GLA, 1983). An inspection of the 90 urban storm water outfalls draining into Grays Harbor in Washington showed that 32% had dry weather flows (Pelletier and Determan, 1988). An additional 19 outfalls were considered suspect, based on visual observation and/or elevated pollutant levels compared to typical urban storm water runoff.

The Huron River Pollution Abatement Program ranks as one of the most thorough and systematic early investigations of illicit discharges (Washtenaw County, 1988). More than a thousand businesses, homes and other buildings located in the watershed were dye tested. Illicit connections were found at 60% of the automobile-related businesses tested, which included service stations, automobile dealerships, car washes, and auto body and repair shops. All plating shops inspected were found to have illicit storm drain connections. Additionally, 67% of the manufacturers, 20% of the private service agencies and 88% of the wholesale/retail establishments tested were found to have illicit storm sewer connections. Of the 319 homes dye tested, 19 were found to have direct sanitary connections to storm drains. The direct discharge of rug-cleaning wastes into storm drains by carpet cleaners was also noted as a common problem.

Eliminating illicit discharges is a critical component to restoring urban watersheds. When bodies of water cannot meet designated uses for drinking water, fishing, or recreation, tourism and waterfront home

values may fall; fishing and shellfish harvesting can be restricted or halted; and illicit discharges can close beaches, primarily as a result of bacteria contamination. In addition to the public health and economic impacts associated with illicit discharges, significant impacts to aquatic life and wildlife are realized. Numerous fish kills and other aquatic life losses have occurred in watersheds as a result of illicit or accidental dumping and spills that have resulted in lethal pollutant concentrations in receiving waters.

1.3 Regulatory Background For Illicit Discharges

The history of illicit discharge regulations is long and convoluted, reflecting an ongoing debate as to whether they should be classified as a point or nonpoint source of pollution. The Clean Water Act amendments of 1987 contained the first provisions to specifically regulate discharges from storm drainage systems. Section 402(p)(3)(B) provides that “permits for such discharges:

- (i) May be issued on a system or jurisdiction-wide basis
- (ii) Shall include a requirement to effectively prohibit non-storm water discharges into the storm sewers; and
- (iii) Shall require controls to reduce the discharge of pollutants to the maximum extent practical including management practices, control techniques and system design and engineering methods, and such provisions as the Administrator or the State determines appropriate for the control of such pollutants.”

In the last 15 years, NPDES permits have gradually been applied to a greater range of communities. In 1990, EPA issued a final

rule, known as Phase I to implement section 402(p) of the Clean Water Act through the NPDES permit system. The EPA effort expanded in December 1999, when the Phase II final rule was issued. A summary of how both rules pertain to MS4s and illicit discharge control is provided below.

Summary of NPDES Phase I Requirements

The NPDES Phase I permit program regulates municipal separate storm sewer systems (MS4s) meeting the following criteria:

- Storm sewer systems located in an incorporated area with a population of 100,000 or more
- Storm sewer systems located in 47 counties identified by EPA as having populations over 100,000 that were unincorporated but considered urbanized areas
- Other storm sewer systems that are specially designated based on the location of storm water discharges with respect to waters of the United States, the size of the discharge, the quantity and nature of the pollutants discharged, and the interrelationship to other regulated storm sewer systems, among other factors

An MS4 is defined as any conveyance or system of conveyances that is owned or operated by a state or local government entity designed for collecting and conveying storm water, which is not part of a Publicly Owned Treatment Works. The total number of permitted MS4s in the Phase I program is 1,059.

PHASE I HIGHLIGHTS	
Who must meet the requirements?	MS4s with population $\geq 100,00$
How many Phase I communities exist nationally?	1,059
What are the requirements related to illicit discharges?	Develop programs to prevent, detect and remove illicit discharges



Phase I MS4s were required to submit a two-part application. The first part required information regarding existing programs and the capacity of the municipality to control pollutants. Part 1 also required identification of known “major” outfalls³ discharging to waters of the United States, and a field screening analysis of representative major outfalls to detect illicit connections. Part 2 of the application required identification of additional major outfalls, limited monitoring, and a proposed storm water management plan (EPA, 1996).

Phase I communities were required to develop programs to detect and remove illicit discharges, and to control and prevent improper disposal into the MS4 of materials such as used oil or seepage from municipal sanitary sewers. The illicit discharge programs were required to include the following elements:

- Implementation and enforcement of an ordinance, orders or similar means to prevent illicit discharges to the MS4

³A “major” outfall is defined as an MS4 outfall that discharges from a single pipe with an inside diameter of at least 36 inches, or discharges from a single conveyance other than a circular pipe serving a drainage area of more than 50 acres. An MS4 outfall with a contributing industrial land use that discharges from a single pipe with an inside diameter of 12 inches or more or discharges from a single conveyance other than a circular pipe serving a drainage area of more than two acres.

- Procedures to conduct ongoing field screening activities during the life of the permit
- Procedures to be followed to investigate portions of the separate storm sewer system that, based on the results of the field screening required in Part 2 of the application, indicate a reasonable potential for containing illicit discharges or other sources of non-storm water
- Procedures to prevent, contain, and respond to spills that may discharge into the MS4
- A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from the MS4
- Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials
- Controls to limit infiltration of seepage from municipal sanitary sewers to the MS4

Summary of NPDES Phase II Requirements

The Phase II Final Rule, published in the Federal Register regulates MS4s that meet both of the following criteria:

- Storm sewer systems that are not a medium or large MS4 covered by Phase I of the NPDES Program
- Storm sewer systems that are located in an Urbanized Area (UA) as defined by the Bureau of the Census, or storm sewer systems located outside of a UA that are designated by NPDES permitting authorities because of one of the following reasons:
 - The MS4's discharges cause, or have the potential to cause, an adverse impact on water quality
 - The MS4 contributes substantially to the pollutant loadings of a physically interconnected MS4 regulated by the NPDES storm water program

MS4s that meet the above criteria are referred to as regulated small MS4s. Each regulated small MS4 must satisfy six minimum control measures:

1. Public education and outreach
2. Public participation/involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/Good housekeeping

Under the third minimum measure, an illicit discharge is defined as any discharge to an

MS4 that is not composed entirely of storm water, except allowable discharges pursuant to an NPDES permit, including those resulting from fire fighting activities (40 CFR 122.26(b)(2)). To satisfy this minimum measure, the regulated small MS4 must include the following five components:

- Develop a storm sewer system map that shows the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls
- Prohibit, through ordinance or other regulatory mechanism, non-storm water discharges into the storm sewer system and implement appropriate enforcement procedures and actions
- Develop and implement a plan to detect and address illicit discharges to the MS4
- Educate public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste
- Identify the appropriate best management practices and measurable goals for this minimum measure

PHASE II HIGHLIGHTS

Who must meet the requirements?

Selected small MS4s



How many Phase II communities exist nationally?

EPA estimates 5,000–6,000

What are the requirements related to illicit discharges?

Develop programs to prevent, detect and remove illicit discharges

What is the deadline for meeting these requirements?

Permits issued by March 10, 2003. Programs must be fully implemented by the end of first permit term (5 years)

In the regulation, EPA recommends that the plan to detect and address illicit discharges include procedures for:

- Locating priority areas likely to have illicit discharges (which may include visually screening outfalls during dry weather and conducting field tests of selected pollutants)
- Tracing the source of an illicit discharge
- Removing the source of the discharge
- Program evaluation and assessment

1.4 Experience Gained in Phase I

The Center for Watershed Protection conducted a series of surveys and interviews with Phase I communities to determine the current state of the practices utilized in local IDDE programs, and to identify the most practical, low-cost, and effective techniques to find, fix and prevent discharges. The

detailed survey included 24 communities from various geographic and climatic regions in the United States. Some of the key findings of the survey are presented below (CWP, 2002)⁴.

- Lack of staff significantly hindered implementation of a successful IDDE program. Phase I communities rely heavily on the expertise of their field staff—practical expertise that has been acquired over many years as programs gradually developed. Methods or approaches recommended for Phase II communities should be less dependent on professional judgment.

⁴ Survey results are based on responses from 24 jurisdictions from 16 states. Surveys were supplemented by on-site interviews of staff of eight IDDE programs: Baltimore City, MD; Baltimore County, MD; Boston Water and Sewer Commission (BWSC), MA; Cambridge, MA; Dayton, OH; Raleigh, NC; Wayne County, MI; and Fort Worth, TX. Jurisdictions selected for the survey and interviews represent a variety of geographic and climatic regions. The EPA storm water coordinators for each region of the country were contacted for recommendations on jurisdictions to include in the survey. Also, a variety of jurisdiction sizes in terms of population, IDDE program service area, and land use was targeted.

- Clear and effective ordinance language should be adopted by Phase II communities to ensure that all potential sources of illicit discharges are prohibited, and that the community has sufficient legal authority to inspect private properties and enforce corrections.
- Many communities lacked up-to-date mapping resources, and found that mapping layers such as storm sewers, open drainage channels, waters of the U.S., outfalls, and land use were particularly useful to conduct and prioritize effective field investigations.
- Outfall screening required the greatest staff and equipment resources, and did not always find problem outfalls. Communities recommended a fast and efficient sampling approach that utilizes a limited number of indicator parameters at each outfall to find problem outfalls.
- When purchasing equipment, Phase II programs should communicate with other jurisdictions to consider sharing field equipment and laboratory costs.
- Use of some discharge tracers has proven challenging and sometimes fruitless, because of false or ambiguous results and complex or hazardous analytical methods. Accurate, cost-effective, and safe monitoring methods are needed to effectively use tracers.
- Municipal IDDE programs worked best when they integrated illicit discharge control in the wider context of urban watershed restoration. Table 3 provides some examples of how greater interagency cooperation can be achieved by linking restoration program areas.

In summary, survey communities expressed a strong need for relatively simple guidance to perform illicit discharge investigations. To address this need, the Manual has been designed to make simple program and technical recommendations for Phase II communities to develop cost-effective IDDE programs.

Table 3: Linking Other Municipal Programs to IDDE Program Needs	
Watershed-Related Program	How Program Relates to IDDE Program Needs
Subwatershed Mapping and Analysis	<ul style="list-style-type: none"> • Mapping and aerial photography are critical tools needed for illicit connection detection surveys. GIS tax map layers are often useful to identify property ownership.
Rapid Assessment of Stream Corridors	<ul style="list-style-type: none"> • Observations from physical stream assessments are often useful in identifying problem areas, including dry weather flow outfalls, illegal dumping, and failing infrastructure locations.
Watershed Monitoring and Reporting	<ul style="list-style-type: none"> • Compiled water quality and other indicator data can be useful in targeting problem areas.
Stream Restoration Opportunities	<ul style="list-style-type: none"> • Stream restoration opportunities can often be coordinated with sewer infrastructure upgrades and maintenance.
Watershed Education	<ul style="list-style-type: none"> • Educating the public about unwanted discharges can save programs money by generating volunteer networks to report and locate problem areas. Better awareness by the public can also reduce the likelihood of unintentional cross-connections.
Pollution Prevention for Generating Sites	<ul style="list-style-type: none"> • Providing incentives to businesses to inspect and correct connections can save programs money.

Chapter 2: Components of an Effective IDDE Program

The prospect of developing and administering an IDDE program can be daunting, complex and challenging in many communities. This Chapter organizes and simplifies the basic tasks needed to build a program. In general, a community should consider eight basic program components, as follows:

1. Audit Existing Resources and Programs– The first program component reviews existing local resources, regulations, and responsibilities that bear on illicit discharge control in the community. A systematic audit defines local needs and capabilities, and provides the foundation for developing the initial IDDE program plan over the first permit cycle.

2. Establish Responsibility, Authority and Tracking– This component finds the right “home” for the IDDE program within existing local departments and agencies. It also establishes the local legal authority to regulate illicit discharges, either by amending an existing ordinance, or crafting a new illicit discharge ordinance. This program component also involves creation of a tracking system to report illicit discharges, suspect outfalls, and citizen complaints, and to document local management response and enforcement efforts.

3. Complete a Desktop Assessment of Illicit Discharge Potential– Illicit discharges are not uniformly distributed across a community, but tend to be clustered within certain land uses, subwatersheds, and sewage infrastructure eras. This program component helps narrow your search for the most severe illicit discharge problems,

through rapid analysis of existing mapping and water quality monitoring data.

4. Develop Program Goals and Implementation Strategies– This program component integrates information developed from the first three program components to establish measurable goals for the overall IDDE program during the first permit cycle. Based on these goals, managers develop specific implementation strategies to improve water quality and measure program success.

5. Search for Illicit Discharge Problems in the Field– This component involves rapid outfall screening to find problem outfalls within priority subwatersheds. Results of outfall surveys are then used to design a more sophisticated outfall monitoring system to identify flow types and trace discharge sources. Many different monitoring options exist, depending on local needs and discharge conditions.

6. Isolate and Fix Individual Discharges– Once illicit discharge problems are found, the next step is to trace them back up the pipe to isolate the specific source or improper connection that generates them. Thus, this program component improves local capacity to locate specific discharges, make needed corrections, and take any enforcement actions.

7. Prevent Illicit Discharges– Many transitory and intermittent discharges are produced by careless practices at the home or workplace. This important program component uses a combination of education and enforcement to promote better

pollution prevention practices. A series of carrots and sticks is used to reach out to targeted individuals to prevent illegal or unintentional illicit discharges.

8. Evaluate the Program – The last component addresses the ongoing management of the IDDE program. The measurable goals set for the IDDE program are periodically reviewed and revisited to determine if progress is being made, or implementation strategies need to be adjusted.

Within each program component, a community has many options to choose, based on its size, capability and the severity of its illicit discharge problems. Chapters 3 through 10 address each IDDE program component in more detail, and summarize

its purpose, methods, desired product or outcome, and budget implications. The remainder of each chapter provides program managers with detailed guidance to choose the best options to implement the program component in their community.

Scheduling of the eight IDDE program components is not always sequential and may overlap in some cases. In general, the first four program components should be scheduled for completion within the first year of the permit cycle in order to develop an effective program for the remaining years of the permit. Table 4 summarizes the specific tasks and products associated with each IDDE program component. The scheduling, costs and expertise needed for each IDDE program component are compared in Table 5.

Table 4: Key Tasks and Products in IDDE Program Implementation

Program Component	Key Tasks	Products
1. Audit existing programs	<ul style="list-style-type: none"> • Infrastructure Profile • Existing Legal Authority • Available Mapping • Experienced Field Crews • Access to Lab Services • Education and Outreach Outlets • Discharge Removal Capability • Program Budget and Financing 	<ul style="list-style-type: none"> • Agreement on Lead Agency • 5 year Program Development Plan • First Year Budget and Scope of Work
2. Establish responsibility and authority	<ul style="list-style-type: none"> • Review Existing Ordinances • Define “Illicit” • Provisions for Access/Inspections • Select Enforcement Tools • Design Tracking System 	<ul style="list-style-type: none"> • Adopt or Amend Ordinance • Implement Tracking System
3. Desktop assessment of illicit discharge potential	<ul style="list-style-type: none"> • Delineate Subwatersheds • Compile Mapping Layers/Data • Define Discharge Screening Factors • Screen Subwatersheds for Illicit Discharge Potential • Generate Maps for Field Screening 	<ul style="list-style-type: none"> • Prioritize Subwatersheds for Field Screening
4. Develop program goals and strategies	<ul style="list-style-type: none"> • Community Analysis of Illicit Discharge • Public Involvement 	<ul style="list-style-type: none"> • Measurable Program Goals • Implementation Strategies

Program Component	Key Tasks	Products
5. Search for illicit discharges problems in the field	<ul style="list-style-type: none"> • Outfall Reconnaissance Inventory (ORI) • Integrate ORI data in Tracking System • Follow-up Monitoring at Suspect Outfalls 	<ul style="list-style-type: none"> • Initial Storm Drain Outfall Map • Develop Monitoring Strategy
6. Isolate and fix individual discharges	<ul style="list-style-type: none"> • Implement Pollution Hotline • Trunk and On-site Investigations • Corrections and Enforcement 	<ul style="list-style-type: none"> • Maintain Tracking System
7. Prevent illicit discharges	<ul style="list-style-type: none"> • Select Key Discharge Behaviors • Prioritize Outreach Targets • Choose Effective Carrots and Sticks • Develop Budget and Delivery System 	<ul style="list-style-type: none"> • Implement Residential, Commercial, Industrial or Municipal Pollution Prevention Programs
8. Program evaluation	<ul style="list-style-type: none"> • Analyze Tracking System • Characterize Illicit Discharges Detected • Update Goals and Strategies 	<ul style="list-style-type: none"> • Annual Reports • Permit Renegotiation

IDDE Program Component	When To Do It	Startup Costs	Annual Cost	Expertise Level	Type of Expertise
1. Audit	Immediately	\$	-0-	??	Planning/Permitting
2. Authority	Year 1	\$\$	\$??	Legal
3. Desktop Analysis	Year 1	\$\$	-0-	???	GIS
4. Goals/Strategies	Year 1	\$	-0-	??	Stakeholder Management
5. Field Search/Monitoring	Year 2 to 5	\$\$	\$\$\$\$???	Monitoring
6. Isolate and Fix	Year 2 to 5	\$	\$\$???	Pipe and Site Investigations
7. Prevention	Year 2 to 5	\$\$	\$\$\$??	Education
8. Evaluation/Tracking	Annually	-0-	\$?	Data Analysis
<p>Key: \$ = <\$10,000 \$\$ = \$10,000 - 25,000 \$\$\$ = \$25,000 - 50,000 \$\$\$\$ = > \$50,000</p> <p> ? - Simple ?? - Moderately Difficult ??? - Complex</p>					

2.1 Management Tips To Develop an Effective IDDE Program

Every community will develop a unique IDDE program that reflects its size, development history, land use, and infrastructure. Still, some common threads run through effective and well-managed local IDDE programs. Below are some tips on building an effective local.

1. *Go after continuous sewage discharges first.* Effective programs place a premium on keeping sewage out of the storm drain system. Continuous sewage discharges pose the greatest threat to water quality and public health, produce large pollutant loads, and can generally be permanently corrected when the offending connection is finally found. Intermittent or indirect discharges are harder to detect, and more difficult to fix.

2. *Put together an interdisciplinary and interagency IDDE development team.* A broad range of local expertise needs to be coordinated to develop the initial IDDE plan, as indicated in Table 5. Effective programs assemble an interagency program development team that possesses the diverse skills and knowledge needed for the program, ranging from legal analysis, GIS, monitoring, stakeholder management and pipe repairs.

3. *Educate everybody about illicit discharges.* Illicit discharge control is a new and somewhat confusing program to the public, elected officials, and many local agencies. Effective programs devote considerable resources to educate all three groups about the water quality impacts of illicit discharges.

4. *Understand your infrastructure.* Finding illicit discharges is like finding a needle in a haystack on a shoestring budget. Many indirect or transitory discharges are extremely difficult to catch through outfall screening. Therefore, effective programs seek to understand the history and condition of their storm water and sewer infrastructure to find the combinations that create the greatest risk for illicit discharge. Effective programs also screen land uses to locate generating sites within targeted subwatersheds. For example, knowing the proximity of the infrastructure to the groundwater table or knowing that the sewer collection system has a long transit time can influence the indicator parameters and associated thresholds that a community chooses to target.

5. *Walk all of your streams in the first permit cycle.* Perform a rapid Outfall Reconnaissance Inventory (ORI) on every mile of stream or channel in the community, starting with the subwatersheds deemed to

have the greatest risk. The ORI allows you to rapidly develop an accurate outfall map and quantify the severity of your discharge problems. ORI data and field photos are extremely effective in documenting local problems. Stream walks and the ORI should be conducted regularly as part of an IDDE program. In many areas, it may require as many as three stream walks to identify all outfall locations.

6. *Use GPS to create your outfall map.* In most communities, the storm water system and sewer pipe networks are poorly mapped, and consist of a confusing blend of pipes and structures that were constructed in many different eras. Effective programs perform a field reconnaissance to ground truth the precise locations of all outfalls using GPS technologies. Effective programs have learned to quickly evaluate outfalls of all sizes, and not just major ones (>36 inches in diameter).

7. *Understand your discharges before developing a monitoring plan.* Monitoring is usually the most expensive component of any local IDDE program, so it is extremely important to understand your discharges before committing to a particular monitoring method or tracer. Compiling a simple discharge “fingerprint” library that characterizes the chemistry of major flow types in the community (e.g., sewage, septage, washwater, groundwater, tap water, or non-target irrigation water) is recommended. This library can distinguish flow types and adjust monitoring benchmarks.

8. *Consider establishing an ambient (in-stream) chemical and/or biological monitoring program.* Prioritizing outfall screening and investigation can save time in the field. An ambient chemical or biological monitoring program can provide supplemental

information to help prioritize sites and can be used to document long-term success.

9. Utilize a simple outfall tracking system to organize all your IDDE program data. Illicit discharges are hard enough to find if an organized system to track individual outfalls is lacking. Effective programs develop a unified geospatial tracking system to locate each outfall, and store information on its address, characteristics, photos, complaints and monitoring data. The tracking system should be developed early in the permit cycle so that program managers can utilize it as an evaluation and reporting tool.

10. Outsource some IDDE functions to local watershed groups. Staffing is the greatest single line item expense associated with a local IDDE program, although staffing needs are often temporary or seasonal in nature. Some effective programs have addressed this staffing imbalance by contracting with watershed groups to screen outfalls, monitor stream quality, and handle storm water education. This strategy reduces overall program costs, and increases local watershed awareness and stewardship.

11. Utilize a hotline as an education and detection tool. Citizen hotlines are a low-cost strategy to engage the public in illicit discharge surveillance, and are probably the only effective way to pick up intermittent and transitory discharges that escape outfall screening. When advertised properly, hotlines are also an effective tool to increase awareness of illicit discharges and dumping. Effective programs typically respond to citizen reports within 24 hours, acknowledge their help, and send them storm water education materials. When citizens play a stronger role in reporting illicit discharge problems, local staff can focus their efforts on tracing the problem to its source and fixing it.

12. Cross-train all local inspectors to recognize discharges and report them for enforcement. Effective programs make sure that fire, building, plumbing, health, safety, erosion control and other local inspectors understand illicit discharges and know whom to contact locally for enforcement.

13. Target your precious storm water education dollars. Most programs never have enough resources to perform the amount of storm water education needed to reduce indirect and transitory discharges in their community. Consequently, effective programs target their discharges of concern, and spend their scarce dollars in the subwatersheds, neighborhoods or business sectors most likely to generate them.

14. Stress public health and safety benefits of sewage-free streams. Effective programs publicize the danger of sewage discharges, and notify the public and elected officials about the discharges that need to be prevented or corrected.

15. Calibrate your program resources to the magnitude of the illicit discharge problem. After a few years of analysis and surveys, communities get a good handle on the actual severity of their illicit discharge problems. In some communities, storm drains will be relatively clean, whereas others may have persistent problems. Effective programs are flexible and adaptive, and shift program resources to the management measure that will reduce the greatest amount of pollution.

16. Think of discharge prevention as a tool of watershed restoration. Discharge prevention is considered one of the seven primary practices used to restore urban watersheds (Schueler, 2004). Effective programs integrate illicit discharge control as a part of a comprehensive effort to restore local watersheds.



Chapter 3: Auditing Existing Resources and Programs

Purpose: This program component identifies the most capable local agency to staff and administer the IDDE program, analyzes staffing and resource gaps, and searches for all available local resources and expertise that can be applied to the IDDE program.

Method: The key method used for this program component is a local IDDE “audit,” which consists of external research, agency interviews, and interagency meetings to determine existing resources and program gaps. The audit typically looks at eight major factors needed to build an IDDE program:

- Profile of existing storm water and sewer infrastructure, as well as historical plumbing codes
- Existing legal authority to regulate illicit discharges
- Available mapping data and GIS resources
- Field staff availability and expertise
- Lab/monitoring equipment and analytical capability
- Education and outreach resources and outlets
- Discharge removal capability and emergency response
- Program budgeting and financing

Desired Product or Outcome(s): The desired outcome is an initial five-year IDDE program development plan over the current permit cycle. This will usually consist of an internal agreement on the lead agency, an initial scope of work, the first year budget, and a budget forecast for the entire permit cycle.

Budget and/or Staff Resources Required: The cost to conduct an audit depends on the size of the community, the degree of interagency cooperation, and the local budget process. Plan for less than one staff month for smaller communities, and up to three staff months for larger ones.

Integration with Other Programs: The audit is the best time to integrate the other five minimum management measures required under NPDES Phase II permits, including public education and outreach, public involvement, construction site runoff control, post-construction runoff control, and pollution prevention/good housekeeping for municipal operations.

3.1 Audit Overview

A community should conduct a quick audit of existing and needed capacity when developing its IDDE program. The audit helps develop realistic program goals, implementation strategies, schedules, and budgets to comply with NPDES permit requirements and improve water quality. The audit consists of external research, agency interviews and interagency meetings to determine existing resources and program gaps. The audit examines the community’s current capabilities in eight topic areas: infrastructure profile, legal authority, available mapping, field staff experience, access to monitoring labs, education and outreach resources, discharge removal capability, and program budgets and financing.

Existing expertise is likely divided among multiple agencies (see Table 6) that should be contacted during the audit. Some of these agencies can become important partners in the development and implementation of the IDDE program, and contribute resources, program efficiencies and overall cost savings. The first agencies to interview are local emergency responders that already deal with spills, accidents, hazardous materials and sewage leaks that occur. In addition, it is worth getting to know the local agency responsible for plumbing code inspection during construction.

Table 7 provides representative examples of questions that the audit should ask to determine the needs and capabilities of a community associated with each program element.

Table 6: Potential Local Agencies and Departments to Contact During an Audit	
Audit Topic	Potential Agencies and Departments
Infrastructure Profile	<ul style="list-style-type: none"> • Water and Sewer Authority • Public Works
Existing Legal Authority	<ul style="list-style-type: none"> • Public Works • Planning Department • Parks and Recreation • Environmental Protection • Local Health Department • Road Engineering • Fire, Police or Rescue (Hazardous material responders)
Available Mapping	<ul style="list-style-type: none"> • Public Works • Local Streets/Utilities • Planning and Zoning • Emergency Responders
Field Staff	<ul style="list-style-type: none"> • Public Works • Environmental Compliance • Development Review • Watershed Groups • Fire, Building, Health and Code Inspectors
Access to Lab Services	<ul style="list-style-type: none"> • Public Works • Local College or University • Drinking Water or Wastewater Treatment Plant • Private Contract Monitoring Laboratories • Health Department
Education and Outreach Resources	<ul style="list-style-type: none"> • Parks and Schools • Water and Sewer Utility • Community Liaison Office • Civic and Watershed Groups
Discharge Removal Capability	<ul style="list-style-type: none"> • Fire, Rescue and Police • Public Works • Water and Sewer Utilities • Private Plumbing Contractors
Program Budget and Financing	<ul style="list-style-type: none"> • Grants • Fines • Application fees • Utility Fees • Department Operating Budget

Table 7: Potential IDDE Audit Questions	
Audit Topics	Questions
Infrastructure Profile	<ul style="list-style-type: none"> • How many miles of streams and storm drains exist in the MS4? • What is the area served by storm drains, sewers, and septic? • What is the general age and condition of the infrastructure?
Existing Legal Authority	<ul style="list-style-type: none"> • Does an illicit discharge ordinance already exist? • Does effective inter-departmental coordination and cooperation currently occur? • Is there an existing reporting and tracking system (e.g., hotline)? • Is the municipality involved with industrial storm water NPDES permit activities or pre-treatment programs?
Available Mapping Data	<ul style="list-style-type: none"> • Does current GIS data exist and does it include coverage of sanitary and storm sewer networks? • Is there a centralized location for the data? • Are digital and hardcopy versions of mapping data readily available?
Field Staff	<ul style="list-style-type: none"> • Are municipal staff available to walk stream miles and record information? • Do municipal staff have the training and expertise to lead a field team? • Are basic field supplies already owned by the municipality and available for use?
Access to Lab Services	<ul style="list-style-type: none"> • Does the municipality have access to an analytical laboratory? • Is there a local university or institution that might be a willing partner? • If yes, is the existing equipment and instrumentation considered to be safe, accurate and reliable? • Are experienced municipal staff available to conduct analytical analyses? • Does the lab and staff have the capability to conduct more sophisticated special studies?
Education and Outreach Resources	<ul style="list-style-type: none"> • Does the community already have an Internet website to post outreach materials? • Are there regular community events that can be used to spread the message? • Are good inter-agency communication mechanisms in place? • Do outreach materials on illicit discharges already exist?
Discharge Removal Capability	<ul style="list-style-type: none"> • Who currently responds to spills, overflows and hazardous material emergencies? • Are municipal staff properly equipped and trained to repair most common types of illicit connections? • Does the municipality have clear authority identifying responsible parties? • Is there a response time commitment to known and reported problems? • Is there a list of pre-approved contractors to perform corrections?
Program Budget and Financing	<ul style="list-style-type: none"> • Is there a dedicated annual budget line item planned for the IDDE program? • Are there cost-share arrangements/opportunities available with other departments? • Have grant awards been awarded to the municipality for special studies associated with watershed restoration in the past?

3.2 Develop Infrastructure Profile

The first part of the audit profiles current and historic storm water and sewer infrastructure in the community. The basic idea is to get a general sense of the magnitude of the task ahead, by looking at the size, age and condition of the storm drain system (and the sewers within the MS4 as well). Some useful planning statistics include:

- Number of storm drain outfalls
- Miles of storm drain pipe
- Total stream and channel miles
- Total area serviced by storm drains
- Total area serviced by sewers
- Total area serviced by septic systems

These statistics are extremely helpful in getting a handle on the total effort required to assess the overall system. Any data on the nature and age of storm drains and sewers can be useful (e.g., open vs. enclosed, young vs. old). The basic infrastructure statistics can be generated from a quick analysis of infrastructure and topographic maps. At this stage, ballpark estimates are fine; more detailed estimates can be developed later in the desktop analysis component.

It is also worth examining historic plumbing codes to determine what kinds of connections were allowed in the past.

Often, interviews with “old-timers” who remember past building codes and practices can provide insights about historical construction as to where illicit connections may be a problem.

3.3 Establish Legal Authority

This part of the audit examines whether a community currently has adequate legal authority to regulate illicit discharges through the following actions:

- Evaluate and modify plumbing codes⁵
- Prohibit illicit discharges
- Investigate suspected illicit discharges
- Require elimination of illicit discharges
- Carry out enforcement actions

The audit of existing legal authority entails a search and review of all existing ordinances that could conceivably bear on illicit discharge control, and interviews with the agencies that administer them. Some common local ordinances that may address illicit discharges are outlined in Table 8. Many communities already have regulations prohibiting specific illicit discharges, such as hazardous chemicals, litter or sewage. Often, public health ordinances may prohibit certain sewage discharges. Local utilities may have plumbing codes and staff capability to track down and remove illicit connections on the system they operate.

⁵ In some states such as NC, plumbing codes are established through a state process. In these cases, local governments typically need specific authority to adopt any local modifications, which can be difficult to obtain. In such states, it may be prudent for the storm water program managers of several local governments to organize as a single cooperative group to modify codes at the state level.

Table 8: Codes and Ordinances with Potential Links to IDDE

<ul style="list-style-type: none"> • Fire codes • Hazardous wastes/spill controls • Health codes • Industrial storm water compliance • Litter control regulations • Nuisance ordinances • Plumbing codes 	<ul style="list-style-type: none"> • Pollution prevention permitting requirements • Restaurant grease regulations • Septic system regulations • Sewer/drain ordinances • Storm water ordinance • Street/highway codes
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To establish legal authority, communities will need to either develop a new IDDE ordinance or modify an existing ordinance that addresses illicit discharges. Language from existing ordinances that addresses illicit discharges should be incorporated or cross-referenced into any new IDDE ordinance to minimize conflicts and confusion. Furthermore, existing code ordinances may need to be amended or superseded to be consistent with the new IDDE ordinance.

In some instances, communities may want to consider collaborating with neighboring or nearby MS4s to develop ordinance language and legal authority, particularly if they share a common receiving water. Non-municipal permittees such as Departments of Transportation and special districts may also look to collaborate with municipal MS4s when considering ordinance language and legal responsibility.

3.4 Review Available Mapping

The third part of the audit looks at the coverage and quality of mapping resources available to support the IDDE program. Specifically, efforts should be made to see if a Geographic Information System (GIS) exists, and what digital mapping layers it contains. If a community does not possess a GIS, a community may choose to establish one (which can be quite expensive), or rely on available hardcopy maps. GIS and hardcopy maps are frequently

available from the following local agencies: planning, tax assessment, public works, parks and recreation, emergency response, environmental, transportation, utilities, or health. If a watershed extends beyond the boundaries of a community, it may be necessary to acquire mapping data from adjacent communities.

Non-local sources of mapping data include state and federal agencies and commercial vendors. EPA and state environmental regulatory agencies maintain lists of NPDES dischargers; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites; Resource Conservation and Recovery Act (RCRA) sites; and other industrial or hazardous material discharge sites. These sites are readily available as GIS layers⁶. Commercial vendors are good sources for low-altitude aerial photos of your community. These can be expensive but are often the best way to get a high-resolution recent ‘snapshot’ of the jurisdiction. Chapter 5 presents more detail on mapping layers needed for an IDDE program.

3.5 Availability of Field Staff

Field staff play a critical role in any IDDE program as they walk streams, assess outfalls, collect samples, respond to discharge complaints, and handle

⁶ Some readily available GIS layers provided by regulatory agencies can be incomplete and inaccurate (particularly with location information). Communities should use their IDDE program and the associated data collection efforts to update their local information associated with these databases.

enforcement. This part of the audit evaluates the availability of local staff to perform these functions, and their training needs. Phase I communities report that experienced field staff are a major factor in IDDE program success.

Experienced staff can be supplemented with support staff such as interns and local watershed groups, if they are properly trained (CWP, 2002). As part of the audit, program managers should investigate whether existing staff can be used or whether new hires are anticipated, and explore intern opportunities with local universities and community colleges. Any local staff with experience in water quality sampling or development inspection should be identified. Fire, building, health, safety and erosion control inspectors are all potential field crew draftees.

An initial estimate of the staff time needed for field crews should be made at this time. Phase I IDDE programs allocated a median of 1.0 person-year for field investigations, with a range of 0.1 to 10 person-years each year (CWP, 2002). Several communities utilized interns to assist with field monitoring and office work. Since many IDDE surveys are short term and seasonal, several communities hired or transferred employees to serve on field crews on a temporary basis. Many Phase I programs found it hard to precisely quantify actual staff time dedicated to IDDE field work because staff were assigned from many departments, or performed other unrelated tasks (building inspections, erosion and sediment control inspections, etc.).

3.6 Access to Laboratory Analysis

This part of the audit identifies the best options for laboratory analysis of water quality samples collected in the field. Four

basic options exist to get access to laboratory services, including:

1. Contract services from a private lab
2. Use existing lab facilities at local drinking water or wastewater treatment plants
3. Partner with a local water and sewer district, university or community college
4. Develop your own “in-house” monitoring and lab capability

The last three options may require purchasing special monitoring analysis equipment, depending on the water quality indicators ultimately selected. If a community is considering developing “in-house” monitoring capabilities, it will need to address quality control, training needs, safety, and hazardous waste disposal. At this point, a community simply wants to acquire data on costs, indicator parameters, quality control, and experience for each of the options being evaluated. Chapter 12 provides more detail on factors to consider when selecting lab analysis options.

3.7 Education and Outreach

The next part of the audit looks at existing educational and outreach resources in the community. To begin, look for other groups that are already involved in storm water or watershed education, including parks, schools, watershed groups, utilities and any other agencies performing this role. Next, look for the current tools the public can use to report water quality problems, such as complaint hotlines, websites or community liaison offices. When these exist, it may be possible to “piggy back” illicit discharge reporting at little additional cost. If reporting tools do not exist, program managers should look for opportunities to share start-up costs

with other agencies that may stand to benefit from improved community interaction (e.g., erosion and sediment control, sanitary sewer overflows, abandoned cars, etc.).

The audit should also look at community-wide events and education outlets to spread the IDDE message, such as fairs, festivals, earth day events, school presentations, and homeowner association meetings. For a complete review of how to craft an effective outreach and education plan, consult Pollution Source Control Practices (Schueler *et al.*, 2004). Excellent education and outreach materials have already been developed by Phase I communities that are available at little or no cost (see Chapter 9). Program managers should consult these resources and modify them as needed to meet their local needs.

3.8 Discharge Removal Capability and Tracking

This part of the audit evaluates local capacity to locate specific discharges, make needed corrections or repairs, and take any enforcement actions. These responsibilities are frequently split among several local agencies. For example, spills are often handled by the fire department hazmat response team, whereas dumping may be enforced by public works. Communities should always coordinate their IDDE program with any experienced hazmat response teams that exist. Similarly, local water and sewer utilities or private contractors that are in the business of repairing pipes should always be consulted. Their experience in specialized techniques such as dye or video testing of pipe interiors is essential for many illicit discharge source investigations. Alternatively, communities can opt to contract out many of these services.

Illicit discharges often occur due to “bad plumbing” connections. Therefore, the audit should identify key building inspectors to determine what, if any, procedures are in place to prevent these deficiencies. Lastly, where corrections to plumbing are required, communities should maintain a list of “pre-approved” plumbing contractors that can promptly and professionally repair the problem.

To ensure coordination, an up-to-date tracking system should be shared among all agencies involved.

3.9 Program Funding

The last part of the audit explores how much the local IDDE program will cost, and how it will be funded. This section provides some general budgeting guidance on the costs to expect for the eight program components. Overall IDDE program costs vary depending on the severity of the illicit discharge problem, the size of the community (and storm drain systems), and the IDDE program choices you make.

Planning level budget estimates can be derived for the eight IDDE program components in three ways. The first way is to look at the cost of IDDE program compliance for Phase I NPDES communities. These costs were assessed in a CWP (2002) survey, and can be used to budget overall annual costs for an IDDE program. Table 9 summarizes median program costs for selected Phase I IDDE program activities. The second technique is to construct unit cost budgets for each program component, based on an assumed level of effort. The third technique relies on EPA’s overall average estimate of compliance costs for Phase II IDDE program of \$1.30 per capita (with a staggering range \$0.04 to \$2.61/capita).

Phase I IDDE Program Costs

The bulk of the cost for most IDDE programs is related to staffing – typically, about 75% of the total budget. Equipment costs were fairly reasonable, with programs spending a median of \$1,000 on office computers and software, and about \$4,000 on field equipment. Many equipment costs can typically be shared across other community programs. Lab costs, for either the purchase of lab equipment or the cost associated with sending samples to labs, were as high as \$87,000 annually, with a median of \$8,000. Finally, most programs had additional budgets for “other” which included items such as education, training, travel, consultants, and contractors.

It is worth noting that program costs presented in Table 9 do not reflect expenditures associated with special investigations, which may be pursued by

communities to isolate specific sources or test new methods or the direct costs to fix problem connections. However, five communities provided data on typical correction costs, with an average cost of \$2,500 per correction (Table 10).

Estimated Phase II IDDE Program Unit Cost

Cost estimates for the eight IDDE program components are outlined in Table 11; more detailed guidance on budgeting for individual program components is provided in subsequent chapters. Under this presentation of cost, data, staff, equipment, and supply costs are combined and incorporated into a primary program element, such as conducting an outfall reconnaissance inventory. This approach assumes a hypothetical scenario of stream/MS4 miles and outfalls to investigate (see Table 11 notes).

Program Element	Median Annual Cost
Staff	\$85,100
Office Equipment (Computer/Software)	\$1,000
Field Equipment	\$4,000
Lab Equipment/Testing	\$8,000
Other	\$10,000
Total	\$121,825

Jurisdiction	Average Cost Per Correction
Cambridge, MA	\$5,000
Boston, MA	\$3,570
Knoxville, TN	\$2,000
Raleigh, NC	\$1,000
Springfield, MO	\$1,000
Average	\$2,500

Table 11: IDDE Program Costs					
IDDE Program Component		Start Up Cost		Annual Cost	
		Low	High	Low	High
Component 1:	a) Perform Audit	\$3,000	\$9,000	NA	NA
	b) Initial Program Plan	\$1,000	\$3,000	NA	NA
Component 2:	a) Adopt Ordinance	\$1,000	\$17,000	NA	NA
	b) Tracking System	\$2,000	\$15,000	\$2,000	\$2,000
Component 3:	a) Desktop Analysis	\$1,000	\$4,000	NA	NA
	b) Field Mapping	\$500	\$1,000	NA	NA
Component 4:	a) Develop Goals	\$1,000	\$3,000	NA	NA
	b) Field Monitoring Strategy	\$1,000	\$3,000	NA	NA
Component 5:	a) Outfall Reconnaissance Inventory (ORI)	NA	NA	\$5,700	\$12,800
	b) Establish Hotline	\$1,300	\$7,700	\$1,500	\$11,400
	c) Sample Analysis	\$500	\$15,500	\$9,000	\$21,200
	d) Outfall Map	NA	NA	\$500	\$1,000
Component 6:	a) Isolate	NA	NA	\$2,000	\$5,200
	b) Fix	NA	NA	\$10,000	\$30,000
Component 7:	a) Education	\$1,000	\$8,100	\$1,300	\$13,900
	b) Enforcement	NA	NA	\$1,000	\$14,000
Component 8:	a) Program Administration	\$10,000	\$15,000	\$10,000	\$15,000
TOTAL		\$23,300	\$101,300	\$43,000	\$126,500
<p>Notes: NA = Not Applicable</p> <p><u>Component 1</u> – Audit assumes \$25/hr, 120 hours for low and 360 hrs for high. Program plan assumes 40 hrs for low and 120 hrs for high.</p> <p><u>Component 2</u> – Ordinance low cost from Reese (2000), high cost from CWP (1998) adjusted and rounded for inflation (2002 \$). Tracking system low cost assumes 40 hrs of development and \$1K of equipment for start up. Annual cost for low assumes 40 hrs per year. High estimates are adapted from Reese (2000) and assume 200 hrs for development and \$3k for equipment at start-up. High annual costs assume 100 hrs per year.</p> <p><u>Component 3</u> – Desktop analysis assumes 1 week for low and 4 weeks for high. Mapping costs assume paper maps (CWP, 1998) under low and GIS under high (40 hrs)</p> <p><u>Component 4</u> – Goals and strategies take 2 weeks for low and 6 weeks for high. Assume even split in time between two tasks.</p> <p><u>Component 5</u> –</p> <p>a) ORI costs are from Ch 11 and assume 10 miles with 2-person crew for low and 20 miles with 3-person crew for high. ORI costs assume work completed in one year, but not necessarily every year (permit cycle cost).</p> <p>Low hotline costs are adapted from Reese (2000). High costs are from CWP research. Low annual costs assume an increased volume of calls due to advertisement and assume 50 hours per year dedicated to this plus annual training.</p> <p>Sample analyses are from various sources and are presented in Chapter 12. Estimates based on 80 samples per year for both (shown as annual cost). Low start up costs are based on contract lab arrangements. High start up costs assume flow type library is developed for eight distinct flow types. Low annual costs assume in-house analysis for Flow Chart Method parameters. High annual costs assume contract lab analysis for 11 parameters.</p> <p>Outfall map costs are same as the component 3 mapping task</p> <p><u>Component 6</u> – Isolate and fix have no assumed start up costs and are both vary depending on the community conditions. Low annual isolation costs assume a one day investigation by a 2-person team per incident (\$400) and four incidents per year plus \$400 in equipment and supplies. High assumes one incident per month. Estimates include on-site inspections. Fix costs are from average costs from Phase I survey and assume same number of incidents as isolate. These costs can often be passed on to responsible parties.</p> <p><u>Component 7</u> – Education estimate adapted from Reese (2000) and assumed to be 1/3 of total Phase I education budget. Some adjustments were made based on assumptions by CWP.</p> <p><u>Component 8</u> – Low assumes 1/6 FTE, high assumes 1/4 FTE at an annual salary of \$60K.</p>					

Financing an IDDE Program

Once the initial budget has been estimated, the next step is to investigate how to pay for it. A full discussion of how to finance local storm water management programs is beyond the scope of this manual, but it is worth consulting APWA (2001). The most common financing mechanisms include:

- Operating budgets
- Debt financing
- State grants and revolving loans
- Property assessments
- Local improvement districts
- Wastewater utility fees
- Storm water utility or district fees
- Connection fees
- Plan review/inspection fees
- Water utility revenues

Of these, storm water utilities or districts are generally considered one of the best dedicated financing mechanisms. Some useful resources to consult to finance your local storm water programs include the following:

- An Internet Guide to Financing Storm Water Management. 2001
<http://stormwaterfinance.urbancenter.iupui.edu>
- Establishing a Storm Water Utility
<http://www.florida-stormwater.org/manual.html>
- Florida Association of Storm Water Utilities. <http://www.fasu.org>

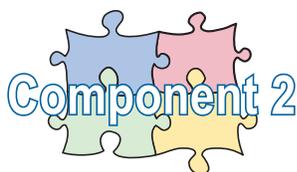
- How to Create a Storm Water Utility
<http://www.epa.gov/nps/urban.html>
- The Storm Water Utility: Will It Work in Your Community?
www.forester.net/sw_0011_utility.html

3.10 The Initial IDDE Program Plan

The local IDDE audit reveals resource gaps, and expertise and staffing needed to build an effective IDDE program. The next step is to organize how you plan to phase in the eight program components over the permit cycle. The process results in the development of an initial IDDE program plan that normally includes five elements:

- Overall schedule for plan implementation, with milestones
- Detailed work plan for the first year
- Budget for the first year
- Five-year budget forecast
- Process for gaining approval for first-year budget

Program managers should consult the next seven chapters for more guidance on planning and budgeting individual IDDE program components.



Chapter 4: Establishing Responsibility and Legal Authority

Purpose: This program component is where the legal and administrative authority is established to regulate, respond and enforce illicit discharges in the community. The component also reviews local plumbing codes to ensure that inappropriate connections are prohibited, and develops a tracking system to locate illicit discharges and track management response.

Method(s): Several methods are used to implement this program component, including development of a new or amended illicit discharge control ordinance and the creation of a relational computer database for internal and external tracking of illicit discharges.

Desired Product or Outcome(s):

- a) Pass or amend a local ordinance that defines the lead regulatory agency, defines the range of illicit discharges to be covered, and specifies the range of enforcement mechanisms.
- b) Establish an internal and external reporting and tracking system. The internal system is structured around the training/education of municipal staff to define and facilitate appropriated response and enforcement procedures. An external system or hotline links to the internal system and assists in response and enforcement by providing access to the public for reporting.

Budget and/or Staff Resources Required: Establishing responsibility, legal authority and an effective tracking system can take as little as a month of staff effort to complete if

no major surprises or unforeseen costs are encountered in the process. However, the actual time-frame to adopt an ordinance or fund a response system, for example, is often much longer, given the crowded schedules of elected officials and timing of the local budget processes. Adoption of the ordinance and the actual budget authorization may require multiple votes over many months or years. Continuous engagement and education of key advisors, agency staff and elected officials are needed throughout the effort. Where hotlines exist (covering a range of municipal functions), significant staff and infrastructure savings should be realized. The primary hurdle in this instance will be employee training and education.

Integration with Other Programs: Public education to advertise the hotline and municipal training to educate employees across departments and agencies are the primary areas where this program component can be integrated with other community-wide initiatives. The hotline can be used to report other watershed and water quality problems (e.g., ESC, dumping, sanitary sewer overflows). Good coordination should occur between tracking repair costs and determining appropriate fine levels for enforcement purposes.

Three critical decisions are needed to implement this program component—what local agency will be responsible for administering the IDDE program, will it have adequate legal authority to do its job, and how will illicit discharges be tracked. Guidance is offered below to help program managers make these decisions.

4.1 Identify Responsible Department/Agency

For most communities, the IDDE program will be established under the same agency or department that oversees all other MS4 NPDES requirements (e.g., Department of Environmental Protection, Department of Public Works, Department of Health, etc.). For small communities, IDDE program administration and implementation may be wrapped into the broad duties of just a few staff. For larger communities, or where there are significant known problems associated with illicit discharges, a community may elect to have a dedicated department division with core staff. In either event, the agency and individuals responsible for the program should be well identified along with a clear understanding of program purpose, goals and actions.

Other local departments may already have authority over certain aspects of illicit discharges. Therefore, close coordination and communication with different departments is essential, and consideration should be given to consolidating responsibilities and authority. If consolidation is not pursued, regular inter-departmental briefings, training sessions, and data sharing will enhance program effectiveness and reduce the likelihood of significant lag times between discovery of a discharge and enforcement or correction due to split responsibilities between departments.

In some cases, communities may want to consider collaborating with adjacent or nearby permittees in order to form a regional approach to addressing illicit discharges. This might be appropriate in situations where municipalities share a common receiving water, and program implementation is conducted on a watershed management basis.

4.2 Develop Local Illicit Discharge Ordinance

A community must demonstrate that it has adequate legal authority to successfully implement and enforce its IDDE program. In fact, establishing legal authority is one of the required components identified in Phase II regulations, and can be identified as a measurable goal. Guidance is provided below on how to develop an IDDE ordinance to establish legal authority.

Reviewing What You Have

Communities with illicit discharge prohibitions in place have typically invoked legal authority using one or more of three mechanisms:

1. Storm water ordinance that prohibits illicit discharges to the drainage network
2. Plumbing code that prohibits illicit connections to the drainage network
3. Health code that regulates the discharge of harmful substances to the drainage network

A few concerns arise with the second and third mechanisms. One example is plumbing codes that only prohibit illicit connections fail to address other common discharges, such as indirect discharges, illegal dumping, or failing infrastructure. Similarly, exclusive reliance on health codes to regulate illicit discharges may not pick up discharges that are not harmful to human health, such as groundwater or potable water infiltration and residential irrigation return flows. With some revision and expansion, one or all of these existing mechanisms can meet the needs of the IDDE program. Alternatively, a new, stand-alone illicit discharge ordinance can be developed that supercedes all other related codes.

CASE STUDY

The City of Raleigh is an NPDES Phase I community. The Water Quality Group (WQG) within the Public Works Department oversees the City's illicit discharges program. The WQG was created in the early 1990s to be responsible for surface water quality across the City and to ensure compliance with the City's NPDES permits. Prior to that, various departments within city government handled water quality issues.

Raleigh's Illicit Discharge Ordinance was adopted in the second year of their original NPDES Phase I permit. The ordinance clearly defines and prohibits illicit discharges and illicit connections; requires containment and clean-up of spills/discharges to, or having the potential to be transported to, the storm drain system (it is also standard operating procedure that the City fire chief be notified of any spills immediately); allows for guaranteed right of entry for inspection of suspected discharges and connections; and outlines escalating enforcement measures, including civil penalties, injunctive relief, and criminal penalties.

Although the WQG runs the IDDE program, some functions are undertaken by the City's Public Utilities Department (e.g., fixing problems in the sanitary line, conducting dye and smoke testing, television inspection of the lines).

Raleigh began with a flat annual IDDE budget based on their past experience of what the program costs to run. More recently, the program began receiving additional funds from the City's storm water utility. A portion of the budget is allocated for testing. Cleaning and correction costs are funded through various budgets depending on the illicit discharge source. The WQG also budgets for two specialists: one is responsible for enforcement and dealing with citizen complaints and the other is responsible for monitoring and tracing the source of problems. The cost of television inspection and smoke testing is included in the Public Utilities Department budget.

Source: Senior (2002, 2004)

The length and complexity of an IDDE ordinance is largely a local community decision. Appendix B provides a model ordinance that may be adapted to meet the specific needs of local communities.

Some key components that should be addressed to ensure full authority to prevent and correct illicit discharges include the following:

- Prohibit illicit discharges

- Investigate suspected illicit discharges
- Require and enforce elimination of illicit discharges
- Address unique conditions or requirements

Defining What is Illicit

An IDDE ordinance should clearly define and/or identify illicit discharges and clearly state that these discharges are prohibited. Some communities may prefer to provide a short, concise definition of illicit discharges, while others may wish to list specific substances or practices that qualify as illicit discharges. However, if a detailed list is provided in the ordinance, a qualifying statement should follow in order to include polluting discharges not specifically listed.

Illicit connections should also be defined in the ordinance. These connections include pipes, drains, open channels, or other conveyances that have the potential to allow an illicit discharge to enter the storm drain system. The prohibition of illicit connections should be retroactive to include connections made in the past, whether or not the connection was permissible at the time. This is especially important if historic plumbing codes or standards of practice allowed for connection of laterals and drains (e.g., shop floor drains) to the MS4.

Lastly, the ordinance should identify categories of non-storm water discharges or other flows to the MS4 that are not considered illicit. For example, the Phase II rule exempts discharges resulting from fire fighting activities. Other activities that are commonly exempt include discharges from dye testing and non-storm water discharges permitted under an NPDES permit, provided that the discharger is in full compliance with the permit. The following categories of non-storm water discharges do not need to be addressed in the IDDE program unless the operator of the regulated small MS4 designates them as significant contributors of pollutants:

- Water line flushing
- Landscape irrigation

- Diverted stream flows
- Rising ground waters
- Uncontaminated ground water infiltration
- Uncontaminated pumped ground water
- Discharges from potable water sources
- Foundation and footing drain water
- Air conditioning condensation
- Irrigation water
- Springs
- Water from crawl space pumps
- Lawn watering
- Individual residential car washing
- Flows from riparian habitats and wetlands

In some cases, communities will need to assess unique local discharges of concern and ensure that they are properly addressed within the ordinance. Examples of unique conditions or requirements sometimes included in IDDE ordinances are septic system provisions, plumbing codes, point of sale dye testing, and pollution prevention plan requirements for certain generating sites.

Provisions for Access and Inspection

Although many communities report that most property owners cooperate when asked for access for illicit discharge investigations, this should never be taken for granted. Indeed, the right of access to private property for inspections is an essential provision of any IDDE ordinance. The ordinance should provide for guaranteed right of entry in case of an emergency or a suspected discharge or at any time for routine inspections, such as dye or smoke tests.

The ordinance should also clarify that right of entry applies to all land uses in the community, and that proof of discharge is not required to obtain entry. It should also state the responsibility of the property owner to disarm security systems and remove obstructions to safe and easy access. Enforcement actions should be established for property owners that refuse access, including the ability to obtain a search warrant through the court system.

Types of Enforcement Tools

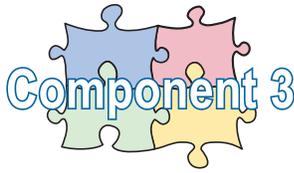
An IDDE ordinance should define a range of enforcement tools so the responsible agency can effectively handle the wide range of illicit discharge violations it is likely to encounter. Potential enforcement tools can range from warnings to criminal prosecution. The choice of enforcement tools should be based on volume and type of discharge, its impact on water quality and whether it was intentional or accidental. In addition, it is helpful to spell out the specific activities that trigger progressively greater enforcement. Table 12 summarizes the range of enforcement tools that have been used by communities to respond to illicit discharges.

The ordinance should provide for escalating enforcement measures to notify operators of violations and to require corrective action. Voluntary compliance should be used for first-time, minor offenders, while more serious violations or continued non-compliance may warrant a more aggressive enforcement approach. Finally, the ordinance should include methods for appeal to provide owners with avenues for compliance.

Establish a Tracking and Reporting System

Communities need to develop tracking and reporting systems to support the entire IDDE program, including enforcement. A relational database with geospatial features provides the greatest flexibility to cover multiple program objectives. From a legal standpoint, tracking systems are important for historical documentation of problems and corrective actions. More details on designing and operating a tracking system are described in subsequent chapters.

Table 12: Summary of IDDE-Related Enforcement Tools	
Type of Enforcement Action	Description
Written Warning with Voluntary Compliance	<ul style="list-style-type: none"> • Applies to first time, minor violations (Field staff should have authority to do this)
Written Notice of Violation Ordering Compliance	<ul style="list-style-type: none"> • Should clearly state description of remedial measures necessary, time schedule, penalties assessed if it doesn't happen, and timeframe for appeal
Administrative Penalties	<ul style="list-style-type: none"> • Daily financial penalty imposed by a responsible department for each day violation remains unfixed
Civil Penalties	<ul style="list-style-type: none"> • Daily financial penalty imposed by judicial authority for each day violation remains unfixed
Compensatory Action	<ul style="list-style-type: none"> • In lieu of enforcement proceedings or penalties, impose alternative compensatory action, e.g., storm drain stenciling, etc.
Criminal Prosecution	<ul style="list-style-type: none"> • Applies to intentional and flagrant violations of ordinance • Each day discharge continues is typically a separate offense • Can result in fines and imprisonment
Cost of Abatement of the Violation/Property Liens	<ul style="list-style-type: none"> • Applies when jurisdiction remedies the discharge or conducts cleanup, but may also be used to recoup administrative costs • May constitute a property lien if not paid within certain timeframe
Emergency Cease and Desist Order	<ul style="list-style-type: none"> • Applies when ordinance continues to be violated • Requires immediate compliance with ordinance by halting operations/terminating discharges • May be a written or verbal order to remove illicit discharge
Suspension of Water or Sewer Service	<ul style="list-style-type: none"> • Applied in emergency situations to immediately discontinue discharge to MS4 • May be applied as enforcement measure when property owner does not comply/fix the problem within timely manner
Stop Work Order	<ul style="list-style-type: none"> • Typically applies to discharges associated with construction activity • No further work can be done until compliance is achieved



Chapter 5: Desktop Assessment of Illicit Discharge Potential

Purpose: This program component uses mapping and other available data to determine the potential severity of illicit discharges within a community, and identifies which subwatersheds or generating land uses merit priority investigation.

Method(s): A simple desktop assessment method can rapidly determine the severity of illicit discharge problems in a community. If an MS4 has fewer than 20 stream miles, this component can be skipped and a community can proceed directly to an ORI. The desktop assessment method has five basic elements:

1. Delineate subwatersheds or other drainage units within your community
2. Compile available mapping and data for each drainage unit (e.g., land use, age, outfalls, infrastructure history)
3. Derive subwatershed discharge screening factors using GIS analysis
4. Screen and rank illicit discharge potential at the subwatershed and community level
5. Generate maps to support field investigations

Desired Product or Outcome(s): The desktop assessment is used to guide initial field screening, and support initial IDDE program decisions. Key outcomes include:

- a) Screening problem catchments or subwatersheds
- b) Creation of GIS or other database system to track outfalls

- c) Gaining an overall assessment as to the severity of illicit discharge problems in the community

- d) Generation of basic mapping for subsequent field work

Budget and/or Staff Resources Required:

The initial desktop assessment of illicit discharge potential should not be a long or arduous process, and should generally take less than four staff weeks. The quality and accuracy of the desktop assessment, however, will vary depending on the extent of available mapping information and GIS data. If mapping information is poor, the desktop assessment should be skipped, and program managers should go directly to the field to inventory outfalls.

Integration with Other Programs: If the desktop assessment suggests few potential illicit discharge problems, program managers may want to combine outfall surveys with broader stream corridor assessment tools such as the Unified Stream Assessment (Kitchell and Schueler, 2004). The desktop assessment provides insight on how to narrow your illicit discharge search, and is helpful when designing a discharge tracking system to best suit your needs. Finally, the desktop assessment can identify subwatersheds, generating sites, and neighborhoods where storm water education should be targeted to address illicit discharge problems.

5.1 Overview of Desktop Assessment of Illicit Discharge Potential

A community should understand the extent of water quality problems caused by illicit discharges. The desktop assessment should not be a time-consuming research effort, but should draw on existing background data and anecdotal information to initially characterize illicit discharge potential at the subwatershed level.

Subwatersheds are then screened based on their composite score, and are designated as having a low, medium or high risk:

- Low – no known illicit discharge problems in the subwatershed
- Medium – problems are confined to a few stream reaches, outfalls or specific generating sites in the subwatershed
- High – Problems are suspected to be severe throughout the subwatershed

The desktop assessment also shapes the overall direction of a local IDDE program. For example, if the desktop assessment indicates that the risk of illicit discharges is low in the community, program managers may want to shift resources to other minimum management measures and integrate them into a broader watershed assessment and restoration effort. For example, IDDE programs may emphasize storm water education, public involvement and hotline setup. By contrast, if the desktop assessment reveals significant potential for severe discharges, program managers will need to allocate significant program resources to find and fix the discharge problems.

The recommended scale for desktop assessments is the subwatershed or sewershed,

which typically range from two to 10 square miles in area. These small planning units are easily delineated on maps or a GIS system. Next, mapping, monitoring and other data are analyzed to identify subwatersheds with the greatest potential to contribute illicit discharges. The sophistication of the analysis varies depending on the data available, but can encompass up to 10 different screening factors. The desktop assessment consists of five basic steps:

Limited mapping or data should not hinder a desktop assessment. Most communities will have some gaps, but should make the most out of what they have. The desktop assessment is an office exercise to locate the most promising subwatersheds to find illicit discharge; subsequent outfall screening is needed to discover the problem outfalls in the field.

Step 1: Delineate subwatersheds

Step 2: Compile mapping layers and subwatershed data

Step 3: Compute discharge screening factors

Step 4: Screen for illicit discharge potential at the subwatershed and community level

Step 5: Generate maps to support field investigations

Step 1: Delineate Subwatersheds

Since hundreds of outfalls and many stream miles exist in most communities, the MS4 should be divided into smaller, more manageable planning units known as subwatersheds. If the community already does watershed planning, these subwatersheds may already be delineated, and should be used for subsequent characterization and screening. Working at the subwatershed scale is usually the

most efficient way to conduct both desktop assessments and field surveys.

In small, heterogeneous or densely developed MS4s, conducting the assessment on a smaller scale may be more effective. In this case, sewersheds or catchments that are less than one square mile in area and have a common outfall or discharge point should be delineated. This finer level delineation allows for a refined characterization that can pinpoint probable sources of illicit discharges, but can obviously consume a lot of time. It should be noted that sewersheds do not always follow topographic delineations and therefore can provide a more accurate picture of the contributing areas to a particular outfall.

If subwatersheds are not yet defined, hydrologic, infrastructure and topographic map layers are needed to delineate the boundaries. Guidance on the techniques for accurately delineating subwatershed boundaries can be found at www.stormwatercenter.net (click “Slideshows,” then scroll down to “Delineating Subwatershed Boundaries”). The use of digital elevation models (DEMs) and GIS can also make subwatershed delineation an easier and faster, automated process.

Some subwatersheds extend beyond the political boundaries of a community. Where possible, it is recommended that the entire subwatershed be delineated and assessed in conjunction with neighboring municipalities. This helps to ensure that all potential sources of illicit discharges are identified in the subwatershed, regardless of the community from which they originate.

Step 2: Compile Mapping Layers and Subwatershed Data

Once subwatersheds (or catchments) are delineated, a community can begin to

acquire and compile existing data for each drainage area, preferably with a Geographic Information System (GIS). A GIS allows the user to analyze and manipulate spatial data, rapidly update data and create new data layers, associate data tables with each map layer, and create paper maps to display subwatershed information. A GIS can greatly speed up data compilation and provides greater accuracy in mapping specific locations. The mapping information facilitates the interpretation and understanding of the discharge screening factors (Step 3).

If a community does not currently have a GIS, developing a system from scratch may seem daunting, however, most GIS software can be installed on basic PCs, and free GIS data layers are often available online. The basic elements of a GIS program include a PC, Global Positioning System (GPS) units, a plotter, a digitizer, GIS software, data and staff training. As with many technologies, both low-end and high-end versions are available, as are many add-ons, extensions and tools. While a GIS is not necessary for the IDDE desktop assessment, it does make the process more efficient and accurate, which can save money in the long run. Moreover, other agencies within a community usually need or use GIS and may be willing to share hardware, software, support and development costs⁷.

Acquiring data for each subwatershed is the next step in the desktop assessment process.

The extent and quality of the data available for mapping directly influence subsequent analyses and field investigations. A list of recommended data layers to acquire for the desktop assessment is provided in Table 13.

⁷ If a community plans to defer using GIS, all databases it develops should have location information suitable for later use with GIS (i.e., using suitable georeferencing technology such as GPS).

Some mapping data may exist in GIS format, whereas others are only available in digital or hardcopy formats that need to be converted to GIS. Digital data with a geo-spatial reference such as latitude and longitude, parcel ID numbers or addresses can be directly entered into a GIS, if an existing road or parcel GIS layer can be associated to it. Hardcopy maps can also be digitized to create new GIS data layers. This can be a labor-intensive process, but will only need to be done once and can be easily updated. If GIS is not an option, hardcopy maps and data can be analyzed, with an emphasis on tax maps, topographic maps, historic aerial surveys, and storm drain and outfall maps.

Most data layers can be obtained from local sources, such as the city planning office,

emergency response agency, or public works department. If a subwatershed extends beyond the boundaries of your community, you may need to acquire data from another local government. Some data layers may be available from state and federal agencies and commercial vendors. EPA and most state environmental agencies maintain databases of industrial NPDES, CERCLA, RCRA and other sites that handle or discharge pollutants or hazardous materials. These searchable permit databases are often available as GIS layers (see Appendix A). Commercial vendors are good sources for low-altitude aerial photos of your community. Aerial photos can be expensive but are often the best way to get a recent high-resolution ‘snapshot’ of subwatershed conditions.

Table 13: Useful Data for the Desktop Assessment

	Data	Likely Format
Recommended	Aerial photos or orthophotos	Digital map
	Subwatershed or catchment boundaries	Digital or hardcopy map
	Hydrology including piped streams	Digital or hardcopy map
	Land use or zoning	Digital or hardcopy map
	NPDES storm water permittees	Digital data or map
	Outfalls	Digital or hardcopy map
	Sewer system, 1" = 200' scale or better	Digital or hardcopy map
	Standard Industrial Classification codes for all industries	Digital or hardcopy data
	Storm drain system, 1" = 200' scale or better	Digital or hardcopy map
	Street map or equivalent GIS layers	Digital or hardcopy map
	Topography (5 foot contours or better)	Digital or hardcopy map
Optional	Age of development	Narrative data
	As-builts or construction drawings	Hardcopy map
	Condition of infrastructure	Narrative data
	Field inspection records	Hardcopy or digital data
	Depth to water table and groundwater quality	Digital data or maps
	Historical industrial uses or landfills	Narrative data or hardcopy map
	Known locations of illicit discharges (current and past)	Narrative data or digital map
	Outfall and stream monitoring data	Digital data
	Parcel boundaries	Digital or hardcopy map
	Pollution complaints	Narrative data
	Pre-development hydrology	Narrative data or hardcopy map
	Sanitary sewer Infiltration and Inflow (I/I) surveys	Hardcopy or digital data
	Septic tank locations or area served by septic systems	Hardcopy or digital map
	Sewer system evaluation surveys	Hardcopy or digital data

Alternatively, TerraServer (<http://terraserver.microsoft.com/default.aspx>) is a free mapping resource that most communities can use to get good quality aerial and other coverages (Figure 8 is an example). Higher quality photos may be desirable as more detailed investigations are pursued.

As GIS technology has become more affordable and easier to use, Phase II communities should harness their capabilities to develop the storm sewer system maps required by NPDES permits. GIS can become a powerful tool to track and manage the entire IDDE program, and demonstrate compliance in annual reports. In addition to being a powerful tool for analysis, GIS is also a great tool for communicating with the public. The images that can be created with GIS can summarize tables of data in a way that the public appreciates. If the recommended data layers are not available, a community may want to devote program resources to create or obtain them. Once data layers have been collected and digitized, they can be

entered into the GIS to create a map of each subwatershed (Figure 8). Make sure all data layers are in the same coordinate system, and perform any conversions needed. Clip data layers to subwatersheds to enable calculation of factors such as land use, area, and outfall density. Summary data on subwatershed water quality and statistics on the age and condition of infrastructure should be entered into a database created for analysis in the next step.

Step 3: Compute Discharge Screening Factors

The third step of the desktop assessment defines and computes discharge factors to screen subwatersheds based on their illicit discharge potential (IDP). As many as 10 different discharge screening factors can be derived during the screening process, but not all may apply to every community. The potential screening factors are described in Table 14, along with how they are measured or defined. Keep in mind that

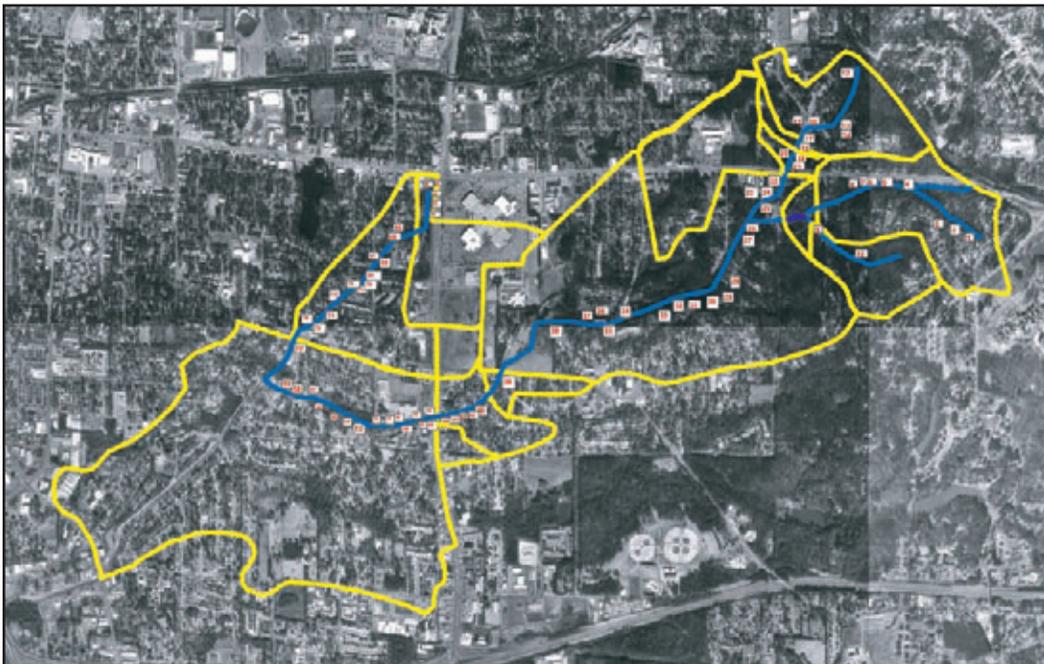


Figure 8: GIS Layers of Outfalls in a Subwatershed

Markings illustrate Tuscaloosa, AL outfalls and drainage areas surveyed as part of this project.

Table 14: Defining Discharge Screening Factors in a Community	
Discharge Screening Factors	Defining and Deriving the Factor
1. Past Discharge Complaints and Reports	Frequency of past discharge complaints, hotline reports, and spill responses per subwatershed. Any subwatershed with a history of discharge complaints should automatically be designated as having high IDP.
2. Poor Dry Weather Water Quality	Frequency that individual samples of dry weather water quality exceed benchmark values for bacteria, nutrients, conductivity or other predetermined indicators. High risk if two or more exceedances are found in any given year.
3. Density of Generating Sites or Industrial NPDES Storm Water Permits	Density of more than 10 generating sites or five industrial NPDES storm water sites per square mile indicates high IDP. Density determined by screening business or permit databases (Appendix A).
4. Storm Water Outfall Density	Density of mapped storm water outfalls in the subwatershed, expressed as the average number per stream or channel mile. A density of more than 20 outfalls per stream mile indicates high IDP.
5. Age of Subwatershed Development	Defined as the average age of the majority of development in a subwatershed. High IDP is often indicated for developments older than 50 years. Determined from tax maps and parcel data, or from other known information about neighborhoods.
6. Sewer Conversion	Subwatersheds that had septic systems but have been connected to the sanitary sewer system in the last 30 years have high IDP.
7. Historic Combined Sewer Systems	Subwatersheds that were once served by combined sewer system but were subsequently separated have a high IDP.
8. Presence of Older Industrial Operations	Subwatersheds with more than 5% of its area in industrial sites that are more than 40 years old are considered to have high IDP. Determined from historic zoning, tax maps, and “old-timers.”
9. Aging or Failing Sewer Infrastructure	Defined as the age and condition of the subwatershed sewer network. High IDP is indicated when the sewer age exceeds design life of its construction materials (e.g., 50 years) or when clusters of pipe breaks, spills, overflows or I/I are reported by sewer authorities.
10. Density of Aging Septic Systems	Subwatersheds with a density of more than 100 older drain fields per square mile are considered to have high IDP. Determined from analysis of lot size outside of sewer service boundaries.

these screening factors are a guide and not a guarantee. Each screening factor is described in detail in the following section.

1. Past Discharge Complaints and Reports

Many communities already have some handle on where illicit discharges have occurred in the past, based on past complaints, reports and interviews with spill responders and public works repair crews. Pollution complaints made to the

local environmental or health department are also worth analyzing. Each of these historical sources should be analyzed to determine if any patterns or clusters where illicit discharges have historically occurred can be found. Ideally, the number of past discharge complaints should be expressed on a subwatershed basis. Even if there is not enough data to quantify past discharges, it may be helpful to get a qualitative opinion from public works crews.

2. Poor Dry Weather Water Quality

If dry weather water quality monitoring data have been collected for local streams, it can be an extremely useful resource to screen subwatersheds for IDP. In particular, look for extreme concentrations of enterococci or *E. coli*, or high ammonia-nitrogen or conductivity. Remember to edit out any samples that were collected during or shortly after storm events, as they reflect the washoff of pollutants during storm water runoff. In general, most communities have more subwatersheds than baseflow monitoring stations, so complete coverage is usually lacking. The following benchmarks are recommended to flag streams with high IDP, based on individual samples of dry weather water quality that exceed:

- Fecal coliform or *E. coli* standards (e.g., typically 1,000 to 5,000 MPN/100 ml)
- Ammonia-nitrogen levels of 0.30 mg/l
- Total phosphorus of 0.40 mg/l
- Conductivity levels that exceed the 90th percentile value for the pooled dataset

Subwatersheds can be classified as having a moderate risk if stream water quality values exceed half the benchmark value. An alternative approach is to statistically analyze long-term dry weather water quality monitoring dataset to define breakpoints (e.g., 50th, 75th, and 90th percentiles).

3. Density of Generating Sites or Industrial NPDES Storm Water Permits

The density of potential generating sites in a subwatershed can be a good screening factor, if land use and business databases are available. The basic database screening method used to locate commercial, industrial, institutional, municipal and

transport-related generating sites is described in Chapter 1 and Appendix A. From the standpoint of discharge screening, the key variable to derive is the density of potential generating sites (e.g., sites/square mile). As a rule of thumb, more than 10 potential generating sites per square mile would indicate a high IDP, while subwatersheds with three to 10 generating sites per square mile might suggest a medium IDP.

Alternatively, communities may want to develop screening factors based on the density of industrial storm water permits in place within the subwatershed. State or federal regulatory agencies often have geospatial databases of industrial NPDES discharges that can be rapidly screened. Pretreatment programs are another valuable source of information on industrial and non-domestic discharges to the sanitary system.

4. Storm Water Outfall Density

The density of outfalls in a subwatershed is an effective discharge screening factor, and is expressed in terms of the number of outfalls per stream mile. Outfall density can be determined by analyzing storm drain maps, if they exist (although they often miss the smaller diameter outfalls that can also produce discharges). In general, subwatersheds that have more than 20 mapped outfalls per stream mile may indicate a higher risk for IDP. Alternatively, the breakpoints for outfall density can be statistically analyzed based on the frequency across all subwatersheds.

5. Age of Subwatershed Development

The average age of development in a subwatershed may predict the potential for illicit discharge problems. For example, a subwatershed where the average age of development is more than 100 years was

probably constructed before sewer service was widely available, and many of the pipes and connections may have changed over the years as a result of modernization and redevelopment. Presumably, the risk of potential discharges would be higher in these older subwatersheds. By contrast, a recently developed subwatershed may have a lower discharge risk due to improved construction materials, codes and inspections.

Therefore, high IDP may be indicated when subwatershed development is more than 50 years old, with medium IDP for 20 to 50 year old development, and low IDP if fewer than 20 years old. You should always check with local building and plumbing inspectors to confirm the building eras used in the screening analysis. The actual age of development can be estimated by checking tax maps and plats, or based on architecture, or common knowledge of neighborhoods.

6. Sewer Conversion

Subwatersheds that were once served by septic systems but were subsequently connected often have a high IDP. These subwatersheds are identified by reviewing past sewer construction projects to determine when and why sewer service was extended.

7. Historic Combined Sewer Systems

Subwatersheds that were once served by combined sewer systems but were subsequently separated often have a high IDP. They can be identified by reviewing past municipal separation projects.

8. Presence of Older Industrial Operations

Older industrial areas tend to have a high potential for illicit cross-connections for several reasons. First, sanitary sewers may not have been installed to handle wash

water, process water and other discharge flows when the operation was originally constructed. In the past, storm drains were often used to handle non-sewage discharges at older industrial facilities. In addition, sanitary and storm drain lines built in different eras are poorly mapped, which increases the chance that someone gets the plumbing wrong during an expansion or change in operations at the facility. As a result, older industries may inadvertently discharge to floor drains or other storm drain connections thinking they are discharging pretreated water to the sanitary sewer. Finally, older industries that produce large volumes of process water may not have enough sanitary sewer capacity to handle the entire discharge stream, causing them to improperly discharge excess water through the storm drain system.

For these reasons, subwatersheds where older industry is present should be regarded as having a high IDP. For operational purposes, older industry is defined as sites that predate the Clean Water Act (e.g., 40 years old or more). They can be identified from historic zoning and land use maps, old parcel records or talking with old-timers.

9. Aging or Failing Sewer Infrastructure

Aging or failing sewer infrastructure often signals potential illicit discharges, and can be defined by the age and condition of the subwatershed sewer network. High IDP is indicated when the sewer age exceeds the design life of its construction materials (e.g., 50 years) or when clusters of pipe breaks, spills, overflows or infiltration and inflow (I&I) are reported by sewer authorities. Older and aging sewer infrastructure experience more leaks, cross-connections and broken pipes that can contribute sewage to the storm drain system. The key factor

to determine is the approximate age of the sewer pipes and their construction materials, which can be gleaned from sewer maps I&I studies, or interviews with crews that regularly repair broken or leaking sewer pipes.

10. Density of Aging Septic Systems

Subwatersheds located outside of the sewer service area are presumably served by septic systems. Septic systems more than 30 years old are prone to failure, based on many site factors (Swann, 2001). In general, a high IDP is indicated if older septic tank density exceeds 100 per square mile. Sewer envelope boundaries or sewer network maps can be helpful to identify subwatersheds that are served by septic systems. Actual density is determined by counting or estimating the total number of septic households in the subwatershed. Tank density should be expressed as septic system units per square mile (average lot size can also be used as a surrogate estimator).

Step 4: Screen for Illicit Discharge Potential at the Subwatershed and Community Level

The process for screening IDP at the subwatershed level is fairly simple. The first step is to select the group of screening factors that apply most to your community, and assign them a relative weight. Next, points are assigned for each subwatershed based on defined scoring criteria for each screening factor. The total subwatershed score for all of the screening factors is then used to designate whether it has a low, medium or high risk to produce illicit discharges. Table 15 provides an example. Based on this comparison, high-risk subwatersheds are targeted for priority field screening. It is important for program managers to track and understand which screening factors contributed to identifying a watershed as “high-risk,” as this may affect the type of investigatory strategy that is used for a particular watershed.

Table 15: Prioritizing Subwatersheds Using IDP Screening Factors

	Past Discharge Complaints/ Reports (total number logged)	Poor dry weather water quality (% of times bacteria standards are exceeded)	Density of storm water outfalls (# of outfalls per stream mile)	Average age of development (years)	Raw IDP score	Normalized IDP score**
Subwatershed A	8 (2)*	30% (2)*	14 (2)*	40 (2)*	8	2
Subwatershed B	3 (1)	15% (1)	10 (2)	10 (1)	5	1.25
Subwatershed C	13 (3)	60% (3)	16 (2)	75 (3)	11	2.75
Subwatershed D	1 (1)	25% (1)	9 (1)	15 (2)	5	1.25
Subwatershed E	5 (1)	15% (1)	21 (3)	20 (1)	6	1.5

Notes:

* The number in parentheses is the IDP “score” (with 3 having a high IDP) earned for that subwatershed and screening factor. Basis for assigning scores (based on benchmarks) to assess IDP is as follows:

Past discharge complaints/reports: <5 = 1; 5-10 = 2; >10 = 3

Dry weather water quality: <25% = 1; 25-50% = 2; >50% = 3

Storm water outfall density: <10 = 1; 10-20 = 2; >20 = 3

Average age of development: <25 = 1; 25- 50 = 2; >50 = 3

** Normalizing the raw IDP scores (by dividing the raw score by the number of screening factors assessed) will produce scores that fall into the standard scale of 1 to 3 for low to high IDP, respectively.

The example provided in Table 15 uses four screening factors to assess five subwatersheds in a community. Data for each factor are compared against assigned benchmarks, as shown in the table. Each subwatershed receives a specific score for each individual screening factor. These scores are then totalled for each subwatershed, and the one with the highest score is given top priority screening. In this case, the screening priority would be given to Subwatershed C, then A, followed by E. Subwatersheds B and D, with the lowest potential for illicit discharges, have the lowest priority.

A similar screening process can be used to evaluate the IDP for the community as a whole. In this case, the entire population of subwatersheds in the community is analyzed to collectively determine the frequency of the three risk areas: high, medium, and low. Predefined criteria for classifying the community’s IDP should be developed.

Table 16 and Figure 9 present an example system for classifying IDP as minimal, clustered or severe, based on the proportion of subwatersheds in each risk category. The community-wide assessment helps program managers define their initial IDDE program goals and implementation strategies, and target priority subwatersheds for field investigations.

Step 5: Generate Maps to Support Field Investigations

The last step in this program component involves generating the maps that field crews need to screen outfalls in priority subwatersheds. More detail on mapping requirements is provided in Chapter 11. The basic idea is to create relatively simple maps that show streams, channels, streets, landmarks, property boundaries and known outfall locations. The idea is to provide enough information so crews can find their way in the field without getting lost, but otherwise keep them uncluttered. Low altitude aerial photos are also a handy resource when available.

Table 16: Community-wide Rating of Illicit Discharge Potential

Rating	Indicators
Minimal (no known problems)	Majority of subwatersheds have a Low IDP risk, with the remainder having Medium IDP risk
Clustered (isolated problems)	More than 20% of subwatersheds with a Medium or High IDP risk that are in close proximity to each other
Severe (severe problems)	More than 50% of subwatersheds with a Medium or High IDP risk or more than 20% of subwatersheds with a High IDP risk

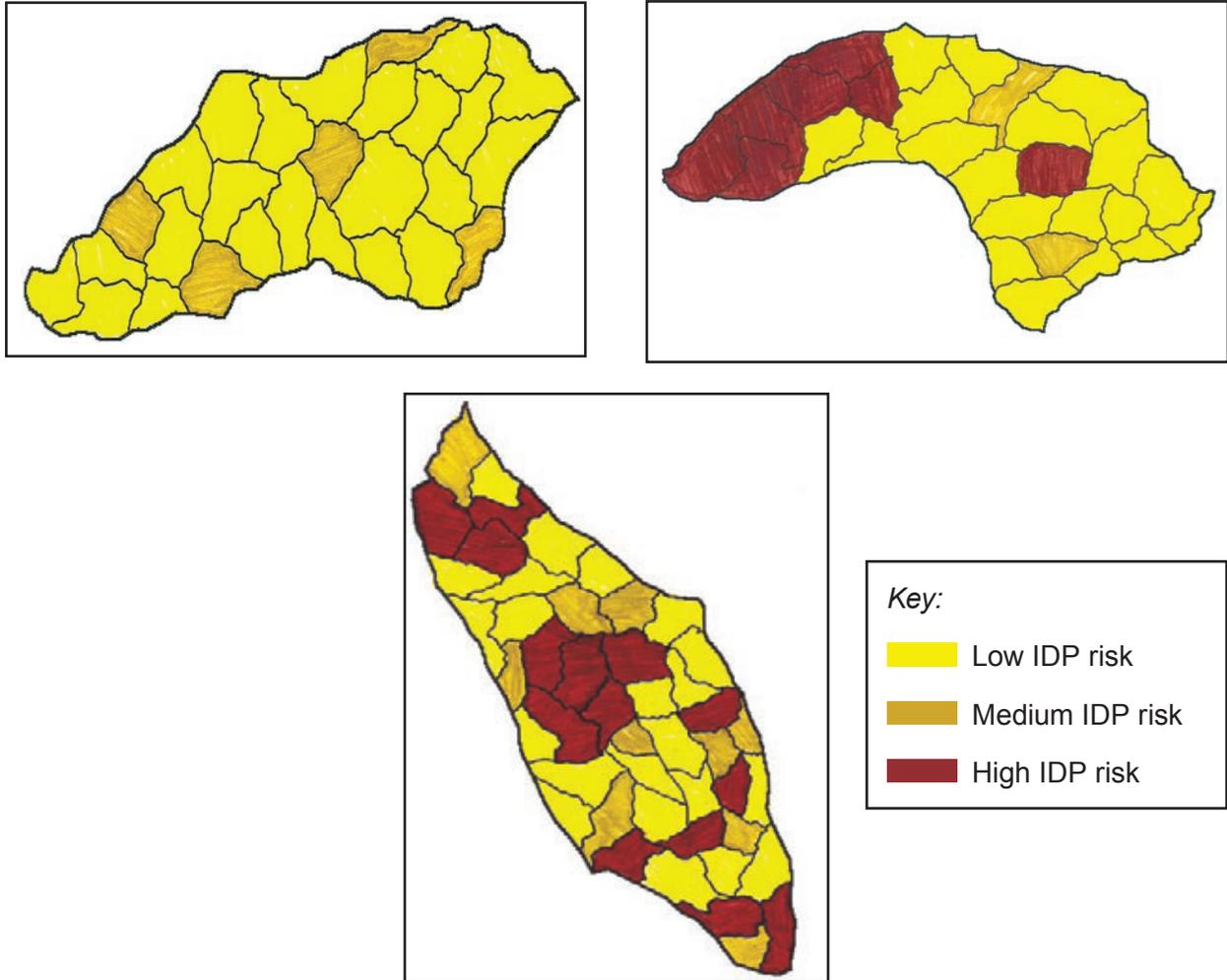
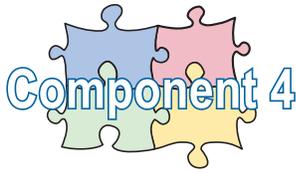


Figure 9: Communities with Minimal (a), Clustered (b), and Severe (c) Illicit Discharge Problems



Chapter 6: Developing Program Goals and Implementation Strategies

Purpose: This program component defines the goals and performance milestones to measure progress in IDDE program implementation during the first permit cycle, and selects the most appropriate and cost-effective strategies to find, fix and prevent illicit discharges. The goals and strategies ensure that scarce local resources are allocated to address the most severe illicit discharge problems that cause the greatest water quality problems in the community.

Method: The basic method is to analyze the results of the IDDE audit, desktop analysis and local water quality conditions to develop realistic, achievable and measurable goals for the program. The public and other stakeholders should be involved in the goal setting process. Once goals are selected, program managers need to select the appropriate implementation strategies and develop a timeline to make them happen. Both goals and strategies should closely align with the type and severity of water quality problems and local watershed management priorities. The probable contribution of illicit discharges to specific water quality problems should be estimated or modeled to determine the degree to which control efforts can meet local TMDLs, bacteria standards for water contact recreation, or other local water quality concerns.

Desired Product or Outcome(s): Agreement on program goals, measurable indicators and implementation strategies that address four key areas:

- Overall program administration
- Outfall assessment
- Finding and fixing illicit discharges
- Prevention of illicit discharges

Budget and/or Staff Resources Required: Staff effort to draft the goals and strategies, conduct needed meetings, respond to comments and finalize ranges from two to six weeks. Goals and strategies should be revisited and updated annually and at the end of each permit cycle. Staff and budget costs are not anticipated to be high unless a fundamental shift in program goals occurs.

Integration with Other Programs: Goal setting is always a good opportunity for public involvement, storm water education and watershed outreach. Effective implementation strategies often involve cost sharing with other departments and even other communities for monitoring equipment and lab facilities, hotlines, and education (e.g., public health/septic system programs).

6.1 Overview of Goals and Strategies Development

Communities can define program goals and implementation strategies once they understand the extent of their illicit discharge problem and how it influences local water quality. Initial program goals should be realistic and provide specific completion milestones to measure program compliance. Measurable goals enable a community to track and evaluate permit compliance over time, and to reassess and modify the program over time. The most basic measure of program effectiveness is to assess whether program goals are being met. So, if a program goal is to walk all stream miles and inventory all outfalls in the MS4 within the first permit cycle, this becomes a benchmark that determines program effectiveness. If a community finds that they only managed to walk and inventory 80% of stream miles, the program may need to be modified so that a full screening sweep is completed in a permit cycle, or they may need to adjust the goal or benchmark.

6.2 Develop Initial Program Goals

The NPDES Phase II MS4 permit regulations grant communities considerable flexibility to develop program goals, as long as they are defined in a measurable way to gauge permit compliance and program effectiveness. EPA (2000e) states that goals “should reflect the needs and characteristics of the operator and the area served by its small MS4. Furthermore, they should be chosen using an integrated approach that fully addresses the requirements and intent of the minimum control measure.”

With this in mind, a series of representative goals that might be set for an IDDE program are presented in Table 17, along with proposed milestones. Four broad types of goals should be developed for every program:

1. Overall program administration
2. Outfall assessment
3. Preventing illicit discharges
4. Finding and fixing illicit discharge

The assumed timeframe is based on a five-year permit cycle. Some of the program goals outlined in Table 17 are considered essential while others are optional or recommended. Communities should feel free to adapt these suggested program goals to reflect their unique conditions and capabilities, or create new ones. The key point is that program goals should always have a timeframe to serve as a benchmark for whether the goal has been achieved.

Implementation strategies are designed to achieve program goals, and vary depending on the types and severity of illicit discharge problems in the community. These are outlined in more detail in the next section.

Table 17: Measurable Goals for an IDDE Program		
EXAMPLE MEASURABLE GOALS	TIMEFRAME	PRIORITY
Goals related to overall program administration		
Audit existing capabilities and identify needs	Immediately	●
Designate one program head and identify key support staff		●
Develop a complete list of ongoing activities related to IDDE		○
Coordinate and communicate with other affected agencies	At program start up and continuously and regularly after that	●
Develop a projected 5-year budget		●
Secure funding to match 5-year goals		●
Draft and promulgate new or modified ordinance	Year 1	●
Establish a tracking and reporting system	Year 1	●
Goals related to outfall assessment		
Define and characterize drainage areas or sewer sheds	Year 1	●
Walk all stream miles	Begin in Year 1 and complete first screening by end of permit cycle. Repeat once per permit cycle	●
Develop a digital (e.g., GIS) map of all outfalls, land use, and other relevant infrastructure	Year 1 and continuously and regularly after that	●
Secure analytical laboratory services either internally or by arrangement with a private laboratory	Initiate in conjunction with field screening	●
Sample and trace the source of a percentage of flowing outfalls each year of permit cycle	Initiate during first permit cycle and expand and enhance where problems are observed	●
Conduct regular in-stream assessments		○
Conduct investigations at a percentage of non-flowing outfalls with poor in-stream water quality to look for intermittent flows		○
Integrate all collected stream data and citizen complaints into the GIS system	Initiate during first year and expand and enhance with time	○
Goals related to preventing illicit discharges		
Distribute educational materials to citizens and industries	Initiate during first year and expand and enhance with time	○
Conduct storm drain stenciling	Initiate during first permit cycle and expand and enhance where problems are observed	○
Hold hazardous waste collection days at least annually		○
Conduct upland subwatershed site reconnaissance surveys to better characterize generating site potential		○
Goals related to finding and fixing illicit discharges		
Develop a spill response plan and coordinate emergency response with other agencies	Immediately	●
Remove all obvious illicit discharges	Ongoing in conjunction with field screening and in response to hotline reports	●

Table 17: Measurable Goals for an IDDE Program		
EXAMPLE MEASURABLE GOALS	TIMEFRAME	PRIORITY
Train staff on techniques to find the source of an illicit discharge	Initiate during first year and expand and enhance with time	●
Repair a fraction of the illicit discharges identified through field screening or citizen complaints	Initiate during first permit cycle and expand and enhance where problems are observed	●
Establish a hotline for public to call in and report incidents (consider establishing performance standards, such as guaranteed response time)	Initiate during first year and expand and enhance with time	○
Inspect and dye-test all industrial facilities	Initiate during first permit cycle and expand and enhance where problems are observed	○
Develop a system to track results of on-site inspections	Initiate during first year and expand and enhance with time	○
Establish an Adopt-a-Stream program	Initiate during first permit cycle and expand and enhance where problems are observed	○
Establish pre-approved list of plumbers and contractors to make corrections	Initiate during first year and expand and enhance with time	○
Key: ● Essential ○ Optional but Recommended		

Ultimately, IDDE program goals should be linked to water quality goals. Some common examples of water quality goals include:

- Keep raw or poorly-treated sewage out of streams
- Reduce pollutant loads during dry weather to help meet the TMDL for a water body
- Meet bacteria water quality standards for contact recreation during dry weather flows
- Reduce toxicant and other pollutant discharges to a stream to restore the abundance and diversity of aquatic insects or fish

A well-designed IDDE program may not guarantee that water quality goals will be always be achieved. Indeed, if program managers can document that illicit discharges do not contribute to poor water

quality, they may want to shift resources to other pollution sources or practices that do. Burton and Pitt (2002) offer a complete discussion on designing and conducting a receiving water investigation.

6.3 Crafting Implementation Strategies

In order to meet program goals, managers must devise cost-effective implementation strategies that are most appropriate for the types of illicit discharge problems they actually have. The community-wide illicit discharge potential (IDP) developed during the desktop analysis can be quite helpful in choosing implementation strategies. Table 18 presents implementation strategies that are geared to the findings of the community-wide IDP. As the community acquires more program experience, they can refine the strategies to better address program goals or unique watershed conditions (Table 19).

Perhaps the most important implementation strategy is targeting—screening, education and enforcement efforts should always be focused on subwatersheds, catchments or generating sites with the greatest IDP. Adaptability after program startup is also

an important strategy. Strategies developed from the desktop analysis should be constantly adjusted to reflect knowledge gained from field screening, hotline reports and other monitoring information.

Table 18: Linking Implementation Strategies to Community-wide IDP

Type	Examples of Implementation Strategy
Minimal IDP	<ul style="list-style-type: none"> • Conduct field screening of outfalls in the context of broader watershed assessment and restoration initiatives using the Unified Stream Assessment (CWP, 2004) or a comparable physical stream assessment approach that has broader focus and benefits. • Integrate IDDE program efforts into more comprehensive watershed assessment and restoration efforts where multiple objectives are being pursued (e.g., storm water education). • Target and coordinate with existing small watershed organizations as partners to accomplish inventory and data collection efforts. • Establish hotline to report suspicious discharges.
Clustered IDP	<ul style="list-style-type: none"> • Conduct limited sampling in the suspect areas. The most cost-effective approach will likely involve using outside laboratory services to avoid capital costs for special equipment (in some cases a municipal laboratory may be available for limited cost). • Select a small set of indicator parameters using the nature of historic problems and land use as a guide. • Target education program in problem areas. • Look for partnerships with local watershed groups to regularly monitor problem areas. • Establish a hotline to report suspicious discharges.
Severe IDP	<ul style="list-style-type: none"> • Establish a hotline to report suspicious discharges. • Conduct and repeat screening in all subwatersheds • Plan for more rigorous sampling approach to make establishment of internal laboratory set up more cost effective (i.e., plan for equipment expenditures for sample collection and analysis). Considerations include: expanding set of parameters to use as indicators, adopting a strategy for targeting intermittent discharges, and establishing in-stream stations to supplement screening effort. • Develop a community-specific chemical “fingerprint” of various flow sources to facilitate differentiation between likely flow sources. • Develop community-wide educational messages aimed at increasing public awareness and targeted education programs tailored to problem areas. • Look for partnerships with local watershed groups to be regular monitors of problem areas through an adopt-a-stream approach. • Emphasize cross-training of municipal employees to develop a broader reach of program efforts and lead by example by ensuring municipal facilities are not contributing to illicit discharge problem.

Table 19: Customizing Strategies for Unique Subwatershed Screening Factors		
Initial Problem Assessment	Screening Factor (from Table 14)	Example Implementation Strategies
Aging Sewer Infrastructure and/or Converted Combined System	<ul style="list-style-type: none"> • Complaints of sewage discharges • Poor dry weather quality • High outfall density • Septic to sewer conversion • Historic combined system • Aging sewers 	<ul style="list-style-type: none"> • Institute a point of sale inspection and verification process. • Select a small set of indicator parameters that focuses on sewage connections. • Develop cost share program to assist property owners with connection correction.
Aging Septic Infrastructure and/or Converted Combined System	<ul style="list-style-type: none"> • Aging septic systems 	<ul style="list-style-type: none"> • Develop targeted education program for septic system maintenance and institute a point of sale inspection and verification process. • Develop cost share capabilities to assist property owners with upgrade of system.
Discharges from Generating Sites	<ul style="list-style-type: none"> • Density of generating sites • Older industry • Past complaints and reports 	<ul style="list-style-type: none"> • Link IDDE program to existing industrial NPDES discharge permits, and inspect storm water management pollution prevention plans. • Develop targeted training and technical assistance programs tailored to specific generating sites. • Aggressively enforce fines and other measures on chronic violators.
High Spill or Dumping Potential	<ul style="list-style-type: none"> • Past complaints and reports 	<ul style="list-style-type: none"> • Establish a hotline and develop community-wide educational messages aimed at increasing public awareness. • Look for partnerships with local watershed groups to regularly monitor or adopt problem sites. • Increase number and frequency of used oil and hazardous waste recycling stations. • Post signs, with hotline reporting number at dumping sites.



Chapter 7: Searching for Illicit Discharge Problems in the Field

Purpose: This program component consists of detective work, and involves rapid field screening of outfalls in priority subwatersheds followed by indicator monitoring at suspect outfalls to characterize flow types and trace sources.

Method(s): The primary field screening tool is the Outfall Reconnaissance Inventory (ORI), which is used to find illicit discharge problems and develop a systematic outfall inventory and map of the MS4. The ORI is frequently supplemented with more intensive indicator monitoring methods to test suspect outfalls. A wide range of monitoring methods can be used; this chapter describes a framework for choosing the safest, most accurate and repeatable methods for a community.

Desired Product or Outcome(s): The search for illicit discharge problems yields several important management products, including:

- An updated map of the locations of all outfalls within the MS4
- Incorporation of ORI data into the outfall inventory/tracking system
- Design and implementation of an indicator monitoring strategy to test suspect outfalls
- Creation of a local chemical “fingerprint” library of pollutant concentrations for various discharge flow types
- Data reports that evaluate the significance and distribution of illicit discharge problems in the community

Budget and/or Staff Resources Required: Field screening and indicator monitoring can consume substantial staff and budget resources. Monitoring costs are closely related to the number of outfalls screened and the complexity of illicit discharge problems discovered. An MS4 that screens 10 stream miles and analyzes 80 indicator samples each year can expect to spend about \$15,000 to \$35,000. Consequently, choosing which indicator(s) to use in a community (and when and where to use them) ranks as one of the most important budget decisions for any project manager.

Integration with Other Programs: Program managers should explore two strategies to integrate field screening and indicator monitoring with other programs to achieve cost savings. The first strategy links outfall screening to broader stream corridor assessments that support local watershed restoration efforts. Often, watershed organizations and “stream waders” can be enlisted and trained to conduct outfall screening. The second strategy is to find a local agency partner to conduct laboratory analysis (such as a drinking water or wastewater treatment plant).

7.1 Overview of Searching for Illicit Discharge Problems in the Field

This chapter provides basic information about the field and laboratory strategies needed to detect illicit discharges, beginning with a field screening technique designed to gather basic information and identify highly suspect outfalls or obvious discharges. Next, it provides a basic framework for using the data from this screening to address obvious discharges, develop a chemical monitoring program, and make future program decisions. Finally, it summarizes the basic options for conducting an ongoing chemical monitoring program. The approaches outlined here are only summarized briefly, and primarily in the context of overall program management. Much more detailed and “hands-on” information is provided in Chapters 11 and 12 that provide specific methods and technical guidance for field crew and laboratory staff.

7.2 The Outfall Reconnaissance Inventory (ORI)

The field screening technique recommended for an IDDE program is the Outfall Reconnaissance Inventory or ORI. The ORI is a stream walk designed to inventory and measure storm drain outfalls, and find and correct continuous and intermittent discharges without in-depth laboratory analysis (Figure 10). The ORI should be completed for every stream mile or open channel within the community during the first permit cycle, starting with priority subwatersheds identified in the desktop analysis. Outfall screening requires relatively little expertise, and can be incorporated into other stream assessments such as the Unified Stream Assessment (Kitchell and Schueler, 2004).

The ORI can discover obvious discharges that are indicated by flowing outfalls with very high turbidity, strong odors and colors, or an “off the chart” value on a simple field test strip. When obvious discharges are found, field crews should immediately track down and remove the source (see Chapters 8 and 13). In other instances, ORI crews may encounter a transitory discharge, such as a liquid or oil spill that should be immediately referred to the appropriate agency for cleanup (Figure 11).



Figure 10: Measuring an outfall as part of the ORI



Figure 11: Some discharges are immediately obvious

The ORI is not meant to be a “one size fits all” method, and should be adapted to suit the unique needs of each community. Program managers should also modify the ORI over time to reflect field observations, crew experience, new or modified indicators, and any other innovations that make fieldwork easier or faster. Table 20 summarizes the four basic steps to conduct an ORI, and more detail on ORI protocols is provided in Chapter 11.

7.3 Interpreting ORI Data

Once the first few ORI surveys are conducted, data can be analyzed to confirm and update the desktop analysis originally used for targeting subwatersheds. The ORI data analysis follows four basic steps, which are described in Table 21. Ideally, ORI data should be stored within a continuously-updated geospatial tracking system.

Step	Strategies
Step 1. Acquire necessary mapping, equipment and staff	<ul style="list-style-type: none"> • Use basic street maps or detailed maps from initial assessment • Minimal field equipment required; use a portable spectrophotometer if desired • Two staff per crew with basic field training required; more specialized staff or training is optional
Step 2. Determine when to conduct field screening	<ul style="list-style-type: none"> • During dry season and leaf off conditions • After a dry period of at least 48 hours • Low groundwater levels
Step 3. Identify where to conduct field screening (based on desktop assessment)	<ul style="list-style-type: none"> • Minimal: integrate field screening with broader watershed or stream assessments • Clustered: screen drainage areas ranking High and Medium first for illicit discharge potential • Severe: screen all outfalls systematically
Step 4. Conduct field screening	<ul style="list-style-type: none"> • Mark and photograph all outfalls • Record outfall characteristics • Simple monitoring at flowing outfalls • Take flow sample at outfalls with likely problems • Deal with major problems immediately

Table 21: Field Data Analysis for an IDDE Program	
Step	Considerations
Step 1. Compile data from the ORI	<ul style="list-style-type: none"> • Compile GPS data and photographs of outfall locations • Enter ORI data into database • Send any samples for lab analysis
Step 2. Develop ORI designation for outfalls	<ul style="list-style-type: none"> • Use ORI data to designate outfalls as having obvious, suspect, potential, or unlikely discharge potential
Step 3. Characterize the extent of illicit discharge problems	<ul style="list-style-type: none"> • Use data from initial assessment • Use outfall designation data • Update initial assessment of illicit discharge problems as minimal, clustered, severe
Step 4. Develop a monitoring strategy	<ul style="list-style-type: none"> • At a minimum, sample 10% of flowing outfalls per year • Repeat field screening in second permit cycle • Use various monitoring methods depending on outfall designation and subwatershed characteristics

7.4 Design and Implementation of an Indicator Monitoring Strategy

The next step is to design an indicator monitoring program to test suspect or problem outfalls to confirm whether they are actually an illicit discharge, and determine the type of flow. From a program management standpoint, six core issues need to be considered during the design of the monitoring strategy, as shown in Table 22.

The indicator monitoring strategy should be concentrated primarily on continuous and intermittent discharges, and can be adapted to isolate the specific flow type found in a discharge. Figure 12 presents an overall monitoring design framework that organizes some of the key indicators and monitoring techniques that may be needed. In general, different indicators and monitoring methods are used depending on whether flow is present at an outfall or not. The details of the discharge monitoring framework are described in Chapter 12. The basic framework should be adapted to reflect the

unique discharge problems and analytical capabilities of individual communities.

Some of the recommended monitoring strategies are discussed below. The preferred method to test flowing outfalls is the **flow chart method** that uses a small set of indicator parameters to determine whether a discharge is clean or dirty, and predicts its or flow type (Pitt, 2004). The flow chart method is particularly suited to distinguish sewage and washwater flow types. Industrial sites may require special testing, and the **benchmark concentrations method** includes several supplemental indicators to distinguish industrial sources.

Table 22: Indicator Monitoring Considerations
<ul style="list-style-type: none"> • Use ORI data to prioritize problem outfalls or drainage areas • Select the type of indicators needed for your discharge problems • Decide whether to use in-house or contract lab analytical services • Consider the techniques to detect intermittent discharges • Develop a chemical library of concentrations for various flow types • Estimate staff time, and costs for equipment and disposable supplies

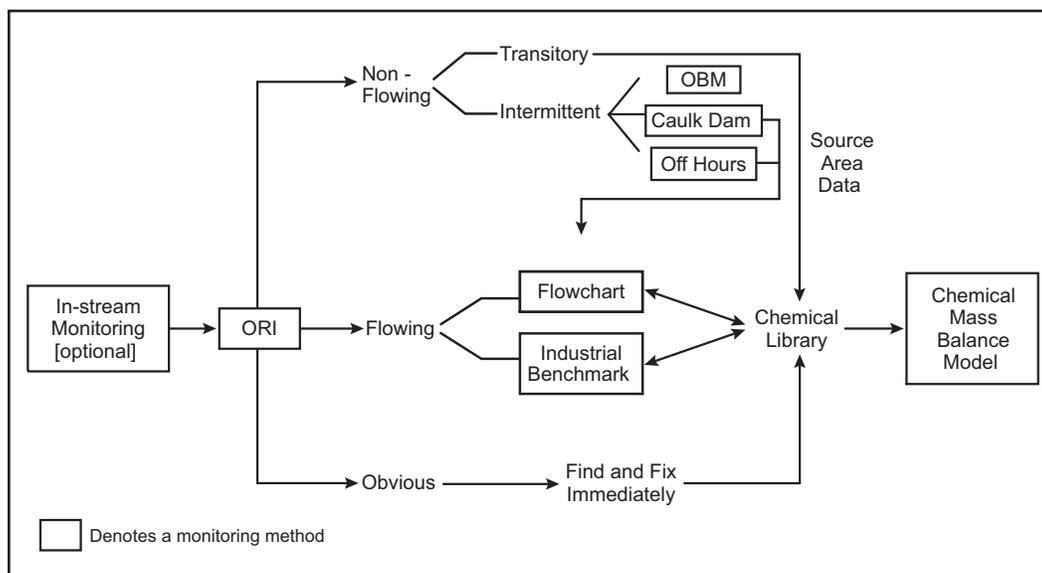


Figure 12: IDDE Monitoring Framework

Non-flowing outfalls are more challenging to diagnose. Intermittent flows can be diagnosed using specialized monitoring techniques such as:

- Off hours monitoring
- Caulk dams
- Optical brightener monitoring traps

When intermittent discharges are captured by these specialized techniques, samples are normally diagnosed using the flow chart method.

Transitory discharges are extremely difficult to detect with routine indicator monitoring, and are frequently identified from hotline reports. Transitory discharges are usually diagnosed by inspection, although water quality samples may be collected to support enforcement measures.

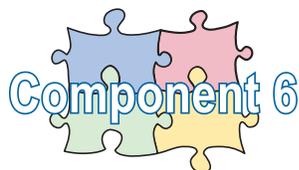
As communities acquire more monitoring data, they should consider creating a **chemical “fingerprint” library**, which is a database of the chemical make-up of the many different flow types in the community. Chemical libraries should include sewage, septage, washwater, and common industrial flows. Default values for the chemical library can initially be established based on existing research and literature values. Data are then updated based on local monitoring to develop more accurate decision points in the flow chart or benchmark methods. Clean water sources such as tap water, groundwater, spring water, and irrigation water are also important entries in the chemical library. The chemical library should also characterize the water quality of known or unknown transitory discharges sampled in the field. Over time, chemical library data should help a community better understand the potential pollutant loads delivered to receiving waters from various generating activities.

These library data can be used to support more advanced strategies such as the **Chemical Mass Balance Model (CMBM)** method. This method, developed by the University of Alabama as part of this project (Karri, 2004), is particularly useful in identifying flow types in blended discharges, where groundwater or tap water is diluted or commingled with sewage and other illicit discharges. The CMBM requires substantial upfront work to develop an accurate chemical library for local flow types. Specifically, the library requires 10-12 samples for each flow type (for industrial flow types, samples can be obtained in association with NPDES pre-treatment programs). A user's guide for the CMBM can be found in Appendix I.

Section 7.5 Field and Lab Safety Considerations

Program managers should take into account and fully plan for all necessary field and laboratory safety precautions. Most communities already have well established standard operating procedures they follow

when conducting field and lab work, and these typically provide an excellent starting point for IDDE programs. Chapters 11, 12, and 13 along with Appendices F and G provide guidance on specific considerations associated with IDDE programs. Of particular note is that program managers may want to consider requiring/recommending field crews be vaccinated against Hepatitis B, particularly if the crews will be accessing waters known to be contaminated with illicit sewage discharges. Program managers should contact local health department officials to explore this issue in more detail prior to making a decision.



Chapter 8: Isolating and Fixing Individual Illicit Discharges

Purpose: This program component uses a variety of tools to trace illicit discharge problems back up the pipe to isolate the specific source or improper connection that generates the discharge. This often requires improved local capacity to locate specific discharges, make needed corrections and maintain an enforcement program to ensure repairs.

Method(s): Five basic tools exist to isolate and fix individual discharges, including:

- Pollution reporting hotline
- Drainage area investigations
- Trunk investigations
- On-site discharge investigations
- Correction and enforcement

Desired Product or Outcome(s): Finding and fixing illicit discharges is the core goal of any IDDE program. The process of finding and fixing discharges has several desirable outcomes, such as:

- Improved water quality
- Increased homeowner and business awareness about pollution prevention
- Maintenance of a tracking system to document repairs and identify repeat offenders.

Budget and/or Staff Resources Required:

Budget and staff resources needed to find illicit discharges vary greatly. Some discharge sources will be immediately obvious, while others will require extensive investigations up the pipe until the source can be sufficiently narrowed. Fixing the problem once it is identified is more predictable and can often involve qualified contractors. Costs associated with repairs can also be fully incurred by the offending party or shared, depending on the nature and extent of the illicit discharge.

Integration with Other Programs:

Two important aspects of this program component can be integrated with other NPDES minimum management measures and storm water permitting. First, the pollution hotline can be an important element of any local storm water education initiative. Second, on-site illicit discharge investigations should be closely coordinated with industrial NPDES storm water site inspections.

8.1 Overview of Isolating and Fixing Individual Illicit Discharges

The ultimate goal of every IDDE program is to find and fix illicit discharges, and a range of tools are available to meet this objective. The ensuing chapter discusses each of the tools in more detail. The choice of which tools are used depends on the nature of the local storm drain system, and the type and mode of entry of the discharges.

8.2 Isolating Illicit Discharges

Outfall screening and monitoring are excellent for finding illicit discharge problems, but they often cannot detect most intermittent or transient flows, nor can they always isolate the exact source, particularly when the outfall has a large contributing area and an extensive pipe network. This section provides guidance on four tools to find individual illicit discharges. The first tool is a pollution complaint hotline, which is particularly effective at finding obvious illicit discharges, such as transitory flows from generating sites and sewer overflows. Citizens provide free surveillance around the clock, and their reports should prompt rapid investigations and enforcement. The other three investigative tools involve drainage area, trunk, and on-site investigations.

Pollution Complaint Hotline

A complaint hotline is a dedicated phone number or website where citizens can easily report illicit discharge and pollution concerns. The hotline should always be supported by prompt investigations of each complaint by trained inspectors, usually within 24 hours. Many Phase I communities have utilized hotlines to track down intermittent and transitory discharges, and regard them as one of their most effective tools to isolate illicit discharges (CWP, 2002). Some of the benefits and challenges Phase I communities have encountered in administering an IDDE complaint hotline is summarized in Table 23.

Six basic steps are needed to establish and maintain a successful IDDE complaint hotline, which are outlined in Table 24. More detailed guidance on establishing a hotline is provided in Appendix C, along with a sample illicit discharge incident tracking form.

It is important to keep in mind that a successful hotline requires considerable advertising and outreach to keep the phone number fresh in the public’s mind. Also, program managers should continuously monitor response times, inspection outcomes, and any enforcement taken. All complaints should be entered into the IDDE tracking system so that complaints can be analyzed.

The cost to establish and maintain a hotline varies, but savings can be realized if it can

Table 23: Benefits and Challenges of a Complaint Hotline

Benefits	Challenges
<ul style="list-style-type: none"> • Leads to early detection and correction of illicit discharges • Encourages active public stewardship • Can “piggyback” on other call response needs • Identifies suspected facilities for further investigation and education • Increases facilities’ and municipalities’ sense of accountability • Increases likelihood of discovering intermittent discharges 	<ul style="list-style-type: none"> • Time and money to provide 24/7 service • Marketing the hotline number • Establishing inter- and intra-departmental process

Table 24: Steps to Creating and Maintaining Successful IDDE Hotline

Steps	Key Elements
1. Define the scope	<ul style="list-style-type: none"> • Determine if a hotline is needed • Define the intent of the hotline • Define the extent of the hotline
2. Create a tracking and reporting system	<ul style="list-style-type: none"> • Design reporting method • Design response method
3. Train personnel	<ul style="list-style-type: none"> • The basics and importance of IDDE • The complaint hotline reporting, investigation and tracking process • How to provide good customer service • Expected responsibilities of each department/agency
4. Advertise	<ul style="list-style-type: none"> • Advertise hotline frequently through flyers, magnets, newspapers, displays, etc. • Publicize success stories
5. Respond to complaints	<ul style="list-style-type: none"> • Provide friendly, knowledgeable customer service • Send an investigator to respond to complaints in a timely manner • Submit incident reports to the hotline database system
6. Track incidents	<ul style="list-style-type: none"> • Identify recurring problems and suspected offenders • Measure program success • Comply with annual report requirements

be piggy-backed on an existing community hotline or cost shared with other communities in the region. Also, hotline costs are related to the volume of calls and the staff effort needed for follow-up investigations. A budgeting framework for establish and maintaining a hotline from scratch is provided in Table 25.

Illicit Discharge Investigations

Once an illicit discharge is detected at an outfall or stream, one of four types of illicit discharge investigations is triggered to track down the individual source. These investigations are often time consuming and expensive, require special training and staff

expertise, and may result in legal action. They include:

- Storm drain network investigations
- Drainage area investigations
- On-site investigations
- Septic system investigations

Each type of investigation handles a different type of discharge problem and has its advantages and disadvantages. More detail on these investigations is provided in Chapter 13.

Storm drain network investigations

Storm drain or “trunk” investigations narrow the source of a discharge

Table 25: IDDE Complaint Hotline Costs

Steps	Initial Cost	Annual Costs
Define the scope	\$1,500	\$0
Create a tracking and reporting system	\$2,500	\$2,440
Train personnel	\$2,200	\$1,000
Advertise	\$1,500	\$2,920
Respond to complaints	\$0	\$5,000
Track incidents		
TOTAL	\$7,700	\$11,360

problem to a single segment of a storm sewer. The investigation starts at the outfall, and the field crew must decide how it will explore the upstream pipe network. The three options include:

- Work progressively up the trunk from the outfall and test manholes along the way
- Split the trunk into equal segments and test manholes at strategic points of the storm drain system
- Work progressively down the trunk (i.e., from the headwaters of the storm drain network and move downstream)

The decision to move up, split, or move down the trunk depends on the nature of the drainage system and the surrounding land use. The three options also require different levels of advance preparation. Moving up the trunk can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Splitting the trunk requires a little more preparation to examine the storm drain system and find the most strategic manholes to sample. Moving down the trunk requires even more advance preparation, since the most upstream segments of the storm drain network may be poorly understood.

Once crews choose one of these options, they need to select the most appropriate investigative methods to track down the source. Common methods include:

- Visual inspection at manholes
- Sandbagging or damming the trunk
- Dye testing
- Smoke testing
- Video testing

Drainage area investigations

Drainage area investigations are initially conducted in the office, but quickly move into the field. They involve a parcel by parcel analysis of potential generating sites within the drainage area of a problem outfall. They are most appropriate when the drainage area to the outfall is large or complex, and when the flow type in the discharge appears to be specific to a certain type of land use or generating site. These investigations may include the following techniques:

- Land use investigations
- SIC code review (see Appendix A)
- Permit review
- As-built review
- Aerial photography analysis
- Infrared aerial photography analysis
- Property ownership certification

On-site investigations

Once the illicit discharge has been isolated to a specific section of storm drain, an on-site investigation can be performed to find the specific source of the discharge. In some situations, such as subwatersheds dominated by industrial land uses or many generating sites, on-site investigations may be immediately pursued.

On-site investigations are typically performed by dye testing the plumbing systems of households and buildings. Where septic systems are prevalent, inspections of tanks and drain fields may be needed.

On-site investigations are excellent opportunities to combine IDDE efforts with industrial site inspections that target review and verification of proper Storm Water

Pollution Prevention Plans. Appendix A provides a list of industrial activities that typically require industrial NPDES discharge permits.

Septic system investigations

Communities with areas of on-site sewage disposal systems (i.e., septic systems) need to consider alternative investigatory methods to track illicit discharges that enter streams as indirect discharges, through surface breakouts of septic fields, or through straight pipe discharges from bypassed septic systems. Techniques can involve on-site investigations or imagery analysis (e.g., infrared aeriels).

8.3 Fixing Illicit Discharges

Once the source of an illicit discharge has been identified, steps should be taken to fix or eliminate the discharge. Four questions should be answered for each individual illicit discharge to determine how to proceed; the answers will usually vary depending on the source of the discharge.

- Who is responsible?
- What methods will be used to repair?
- How long will the repair take?
- How will removal be confirmed?

Financial responsibility for source removal will typically fall on property owners, MS4 operators, or a combination of the two. Methods for removing illicit discharges usually involve a combination of education and enforcement. A process for addressing illicit discharges that focuses on identifying the responsible party and enforcement procedures is presented in Figure 13, while Table 26 presents various options for removing illicit discharges from various sources. Additional information on common removal actions and associated costs can be found in Chapter 14.

Program managers should use judgment in exercising the right mix of compliance assistance and enforcement. The authority and responsibility for correction and enforcement should be clearly defined in the local IDDE ordinance developed earlier in the program. An escalating enforcement approach is often warranted and is usually a reasonable process to follow. Voluntary compliance should be used for first-time, minor offenders. Often, property owners are not even aware of a problem, and are willing to fix it when educated. More serious violations or continued non-compliance may warrant a more aggressive, enforcement-oriented approach.

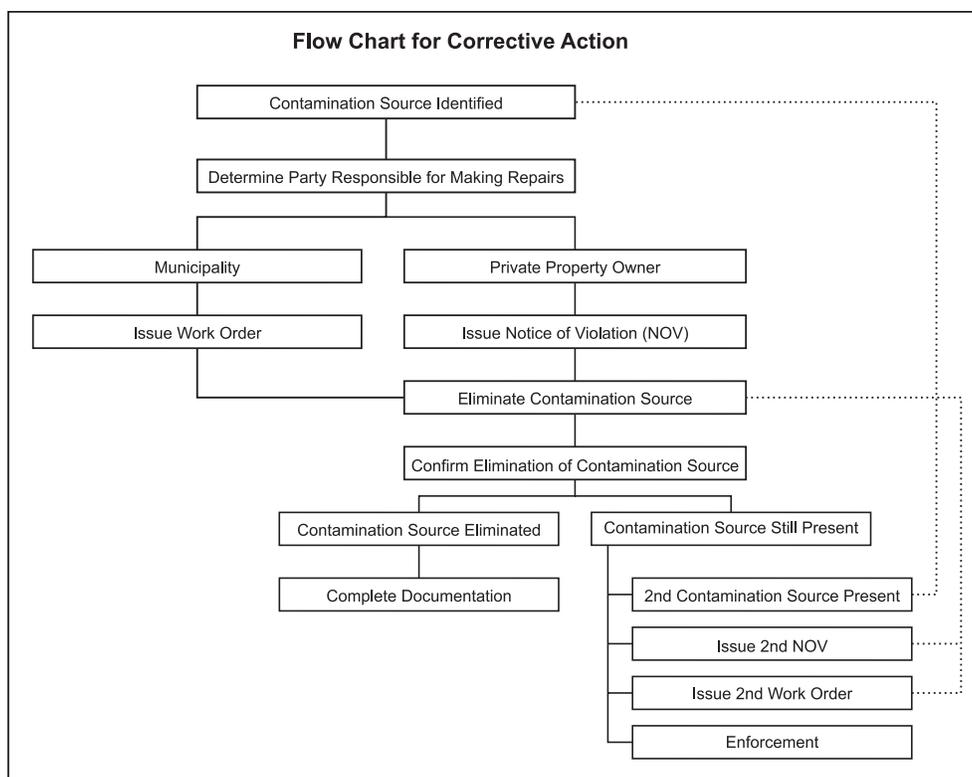


Figure 13: Process for Removing or Correcting an Illicit Discharge

Table 26: Methods to Fix Illicit Discharges		
Type of Discharge	Source	Removal Action(s)
Sewage	Break in right-of-way	Repair by municipality
	Commercial or industrial direct connection	Enforcement
	Residential direct connection	Enforcement; Incentive or aid
	Infrequent discharge (e.g., RV dumping)	Enforcement; Spill response
	Straight pipes/septic	Enforcement; Incentive or aid
Wash water	Commercial or industrial direct connection	Enforcement; Incentive or aid
	Residential direct connection	Enforcement; Incentive or aid
	Power wash/car wash (commercial)	Enforcement
	Commercial wash down	Enforcement
	Residential car wash or household maintenance-related activities	Education
Liquid wastes	Professional oil change/car maintenance	Enforcement; Spill response
	Heating oil/solvent dumping	Enforcement; Spill response
	Homeowner oil change and other liquid waste disposal (e.g., paint)	Warning; Education; Fines
	Spill (trucking)	Spill response
	Other industrial wastes	Enforcement; Spill response



Chapter 9: Preventing Illicit Discharges

Purpose: This program component identifies key behaviors of neighborhoods, generating sites, and municipal operations that produce intermittent and transitory discharges. These key “discharge behaviors” are then targeted for improved pollution prevention practices that can prevent or reduce the risk of discharge. Communities then apply a wide range of education and enforcement tools to promote the desired pollution prevention practices.

Method(s): The Unified Subwatershed and Site Reconnaissance (USSR; Wright *et al.*, 2004) and the desktop analysis of potential generating sites (Chapter 5) are two methods used to identify the major behaviors that generate intermittent and transitory discharges. These methods, used alone or in combination, are extremely helpful to identify the specific discharge behaviors and generating sites that will be targeted for education and enforcement efforts. A Source Control Plan is then performed to select the right pollution prevention message, choose the appropriate combination of carrots and sticks to change behaviors, and develop a budget and delivery system to implement the prevention program. Refer to Schueler *et al.* (2004) for information on developing a Source Control Plan and the many carrots and sticks available to communities.

Desired Product or Outcome(s): The desired outcome is a mix of local prevention programs that target the most common intermittent and transitory discharges in the community. Program managers need to develop targeted pollution prevention

programs for three sectors of the community:

- *Neighborhood Discharges.* The pollution prevention practices related to discharge prevention in residential neighborhoods include storm drain stenciling, lawn care, septic system maintenance, vehicle fluid changing, car washing, household hazardous waste disposal and swimming pool draining.
- *Generating Sites.* This group of pollution prevention practices can reduce spills and transitory discharges generated during common business operations. Practices include business outreach, spill prevention and response plans, employee training and site inspections.
- *Municipal Housekeeping.* This group of pollution prevention practices is performed during municipal operations, such as sewer and storm drain maintenance, plumbing code revision, and provision of household hazardous waste and used oil collection services.

Budget and/or Staff Resources Required:

The budget and staff resources needed for prevention programs can be considerable, and should be coordinated with other storm water education, public involvement and municipal housekeeping initiatives required under NPDES Phase II MS4 permits. Special emphasis should be placed on cross-training staff, partnering with local watershed groups, and pooling educational resources with other communities.

Integration with Other Programs: Illicit discharge prevention is linked to three of the

six NPDES Phase II minimum management measures, and should be closely integrated with local watershed restoration efforts.

9.1 Overview of Preventing Illicit Discharges

Intermittent and transitory discharges are difficult to detect through outfall screening or indicator monitoring. Indeed, the best way to manage these discharges is to promote pollution prevention practices in the community that prevent them from occurring. Effective IDDE programs develop education and outreach materials targeted toward neighborhoods, generating sites, and municipal operations. The discharge prevention message is normally integrated with other storm water education programs required under MS4 NPDES Phase II permits such as

- Public education and outreach
- Public participation/involvement
- Municipal pollution prevention/good housekeeping

9.2 Methods to Identify Opportunities for Illicit Discharge Prevention

The USSR and the desktop analysis of potential generating sites both help identify the major behaviors that generate intermittent and transitory discharges. These assessment methods are briefly described below:

The Unified Subwatershed and Site Reconnaissance (USSR)

The USSR is a field survey that rapidly evaluates potential pollution sources and restoration potential in urban subwatersheds. The survey quickly characterizes upland areas in order to inventory problem

sites that may contribute pollutants and identifies pollution source controls and other restoration projects. For more information on how to conduct the USSR, consult Wright *et al.* (2004). The USSR has four major assessment components, three of which directly relate to illicit discharge prevention:

- *Neighborhood Source Assessment (NSA)*, which helps discover residential pollution source areas and potential restoration opportunities within the many neighborhoods found in urban subwatersheds
- *Hotspot Site Investigation (HSI)*, which ranks the potential severity of each commercial, industrial, institutional, municipal or transport-related hotspot site found within a subwatershed
- *Analysis of Streets and Storm Drains (SSD)*, which measures the average pollutant accumulation in the streets, curbs, and catch basins of a subwatershed

Desktop Analysis of Generating Sites

The desktop analysis method screens local business and permit databases to identify specific commercial, industrial, institutional, municipal, and transport-related sites that are known to have a higher risk of producing illicit discharges. Chapter 5 and Appendix A provide discussions of this analysis.

9.3 Preventing Illicit Discharges from Neighborhoods

Many common neighborhood behaviors can cause transitory discharges that are seldom defined or regulated as illicit discharges by most communities. Individually, these behaviors cause relatively small discharges, but collectively, they can produce significant

pollutant loads. Most communities use outreach and education to promote pollution prevention practices, and some of the more effective practices to influence these behaviors are described in this section:

- Storm drain stenciling
- Septic system maintenance
- Vehicle fluid changing
- Car washing
- Household hazardous waste storage and disposal
- Swimming pool draining

Storm Drain Stenciling

Storm drain stenciling sends a clear message to keep trash and debris, leaf litter, and pollutants out of the storm drain system, and may deter illegal dumping and discharges (Figure 14). Stenciling may increase watershed awareness and neighborhood stewardship and can be used in any neighborhood with enclosed storm drains.

Stenciling is an excellent way to involve the public, and just a few trained volunteers can systematically stencil all the storm drains within a neighborhood in a short time. Volunteers can be recruited from scouting, community service, and watershed organizations, or from high schools and



Figure 14: Storm drain stenciling may help reduce illicit discharges.

neighborhood associations. Program managers should designate a staff person to coordinate storm drain stenciling and be responsible for recruiting, training, managing, and supplying volunteers.

Storm drain stenciling programs are relatively inexpensive. Most communities use stencils, although some are now using permanent markers made of tile, clay, or metal. Stencils cost about 45 cents per linear inch and can be used for 25 to 500 drains, depending on whether paint is sprayed or applied with a brush or roller. Permanent signs are generally more costly; ceramic tiles cost \$5 to \$6 each and metal stencils can cost \$100 or more. More guidance on designing a stenciling program can be found in Schueler *et al.* (2004).

Septic System Maintenance

Failing septic systems can be a major source of bacteria, nitrogen, and phosphorus, depending on the overall density of systems present in a subwatershed (Swann, 2001). Failure results in illicit surface or subsurface discharges to streams. According to U.S. EPA (2002), more than half of all existing septic systems are more than 30 years old, which is well past their design life. The same study estimates that about 10% of all septic systems are not functioning properly at any given time, with even higher failure rates in some regions and soil conditions.

Septic systems are a classic case of out of sight and out of mind. Many owners take their septic systems for granted, until they back up or break out on the surface of their lawn. Subsurface failures, which are the most common, go unnoticed. In addition, inspections, pump outs, and repairs can be costly, so many homeowners tend to put off the expense until there is a real problem. Lastly, many septic system owners are not

CASE STUDY

In 1997, Madison County, NC implemented a project to address straight piping problems. In 1999, a survey identified 205 households with black water straight-piping (toilet waste), 243 households with gray water straight-piping (sink, shower, washer waste), and 104 households with failing septic systems. The project facilitated more than 10 community meetings, and issued more than 20 educational articles on straight-piping and water quality in the local papers. In addition, the project leveraged \$903,000 from the N.C. Clean Water Management Trust Fund to establish a Revolving Loan and Grant Program for low and moderate income county residents that need assistance installing a septic system or repairing a failing one. (Land of Sky Regional Council website, 2002).

aware of the link between septic systems and water quality. Communities can employ a range of tools to improve septic system maintenance. These include:

- Media campaigns and conventional outreach materials to increase awareness about septic system maintenance and water quality (e.g., billboards, radio, newspapers, brochures, bill inserts, and newsletters)
- Discount coupons for septic system maintenance
- Low interest loans for septic system repairs
- Mandatory inspections
- Performance certification upon property transfer
- Creation of septic management districts
- Certification and training of operation/maintenance professionals
- Termination of public services for failing systems

Vehicle Fluid Changing

Dumping of automotive fluids into storm drains can cause major water quality problems, since only a few quarts of oil or a few gallons of antifreeze can severely

degrade a small stream. Dumping delivers hydrocarbons, oil and grease, metals, xylene and other pollutants to streams, which can be toxic during dry-weather conditions when existing flow cannot dilute these discharges. The major culprit has been the backyard mechanic who changes his or her own automotive fluids (Figure 15). Communities have a range of tools to prevent illegal dumping of car fluids, including:

- Outreach materials distributed at auto parts store and service stations
- Community oil recycling centers
- Directories of used oil collection stations
- Free or discounted oil disposal containers
- Pollution hotlines
- Fines and other enforcement actions



Figure 15: Home mechanic changing his automotive fluids

Car Washing

Car washing is a common neighborhood behavior that can produce transitory discharges of sediment, nutrients and other pollutants to the curb, and ultimately the storm drain. Communities have utilized many innovative outreach tools to promote environmentally safe car washing, including:

- Media campaigns
- Brochures promoting nozzles with shut off valves
- Storm drain plug and wet vac provisions for charity car wash events
- Water bill inserts promoting environmentally safe car washing products
- Discounted tickets for use at commercial car washes

Household Hazardous Waste Storage and Disposal

The average garage contains a lot of products that are classified as hazardous wastes, including paints, stains, solvents, used motor oil, pesticides and cleaning products. While some household hazardous waste (HHW) may be dumped into storm drains, most enters the storm drain system as a result of outdoor rinsing and cleanup. Improper disposal of HHW can result in acute toxicity to downstream aquatic life. The desired neighborhood behavior is to participate in HHW collection days, and to use appropriate pollution prevention techniques when conducting rinsing, cleaning and fueling operations (Figure 16).

Convenience and awareness appear to be the critical factors in getting residents to participate in household hazardous waste collection programs. Participation depends



Figure 16: Household hazardous wastes should be properly contained to avoid indirect discharges

on the number of days each year collection events are held and is inversely related to both the distance homeowners must travel to recycle waste and the restrictions on what is accepted. Communities have used a variety of techniques to promote and expand HHW collection, including:

- Mass media campaigns to educate residents about proper outdoor cleaning/rinsing techniques
- Conventional outreach materials notifying residents about HHW and collection days
- More frequent HHW collection days
- Providing curbside disposal options for some HHW
- Establishing permanent collection facilities at solid waste facilities
- Providing mobile HHW pickup
- Waiving disposal fees at landfills

Swimming Pool Draining

Routine and end-of-season maintenance tasks for aboveground or in-ground pools can cause the discharge of chlorinated water or filter back flush water into the storm drain

system or the stream (Figure 17). The ideal practice is to discharge chlorinated pool water into the sanitary sewer system, or hold it until chlorine and temperature levels are acceptable to permit spreading it over a suitable pervious surface.

Most pool owners understand that regular maintenance is essential to keep pools safe and clean, and they may be more receptive to changing discharge behaviors with proper education. Effective outreach methods include:

- Conventional outreach techniques on proper discharge (pamphlets, water bill inserts, posters)
- Educational kiosks at the retail outlets selling pool chemicals
- Changes in local plumbing codes to require discharge to sanitary sewer systems
- Local ordinances that allow for fines/enforcement for unsafe pool discharges



Figure 17: Swimming pools can be a source of illicit discharges.

9.4 Preventing Illicit Discharges from Generating Sites

Many indirect discharges can be identified and prevented using the concept of generating sites, which are a small subset of commercial, industrial, institutional, municipal and transport-related operations that have the greatest risk of generating indirect discharges. Program managers should become intimately familiar with the types of generating sites found in their community, particularly those regulated by industrial NPDES storm water permits. Some of the more common operations that generate spills and transitory discharges are profiled in Table 27.

Most communities consider nearly all non-storm water discharges from generating sites to be illicit, and take a more regulatory approach. Consequently, pollution prevention practices are more prescriptive, and are frequently incorporated into a pollution prevention plan for a facility or operation. Like anyone else, businesses respond better to carrots than sticks, but often need both. Communities possess four broad tools to promote effective pollution prevention practices at generating sites:

- Business outreach and education
- Spill prevention and response planning
- Employee training
- Site inspections

Table 27: Common Discharges Produced at Generating Sites	
Generating Site	Activity Generating the Discharge
Vehicle Operations (Maintenance, Repair, Fueling, Washing, Storage)	<ul style="list-style-type: none"> • Improper disposal of fluids down shop and storm drains • Spilled fuel, leaks and drips from wrecked vehicles • Hosing of outdoor work areas • Wash water from cleaning • Spills
Outdoor Materials (Loading/unloading, Outdoor storage)	<ul style="list-style-type: none"> • Liquid spills at loading areas • Hosing/washing of loading areas into shop or storm drains • Leaks and spills of liquids stored outside
Waste Management (Spill prevention and response, Dumpster management)	<ul style="list-style-type: none"> • Spills and leaks of liquids • Dumping into storm drains • Leaking dumpsters
Physical Plant Maintenance (Building Repair, Remodeling and maintenance, Parking lot maintenance)	<ul style="list-style-type: none"> • Discharges from power washing and steam cleaning • Rinse water and wash water discharges during cleanup • Runoff from degreasing and re-surfacing
Turf and Landscaping (Turf Management Landscaping/Grounds care)	<ul style="list-style-type: none"> • Non-target irrigation • Improper rinsing of fertilizer/pesticide applicators
Unique Hotspot Operations (Pools, Golf Courses, Marinas, Construction, Restaurants, Hobby farms)	<ul style="list-style-type: none"> • Discharge of chlorinated water from pools • Dumping of sewage and grease

Business Outreach and Education

Targeted distribution of educational materials to specific business sectors in the subwatershed is the most common method of promoting pollution prevention. Outreach materials are designed to educate owners and employees about polluting behaviors, recommend appropriate pollution prevention practices, and notify them of any local or state regulations. Useful outreach materials include brochures, training manuals, posters, directories of pollution prevention vendors, and signs. Passive business outreach works best when it is specially adapted and targeted to a specific business sector (e.g., vehicle repair, landscaping, restaurants) and is routinely and directly presented to local business groups and trade associations. Business outreach materials require

employees to read or hear them, and then take active steps to change their behavior.

Communities can also provide direct technical assistance to develop a customized pollution prevention prescription for individual generating sites. In this case, local staff work closely with owners and operators to inspect the site and develop an effective pollution prevention plan. In other cases, pollution prevention workshops or model plans are offered to businesses and trade groups that represent specific groups of generating sites. In either case, the locality acts as a technical partner to provide ongoing consultation to individual businesses to support their pollution prevention efforts.

Spill Prevention and Response

A spill prevention and response plan is useful for any potential generating site, and is mandatory for any operation that uses, generates, produces, or transports hazardous materials, petroleum products or fertilizers. These operations are known as SARA 312 operators and are regulated by state environmental agencies. In addition, all industrial sites regulated by individual or group NPDES storm water permits must have an updated spill prevention and response plan on its premises. Spill containment and response plans should also be prepared for major highways that cross streams and other water bodies, since truck and tanker accidents often represent the greatest potential spill risk in most communities (Figure 18).

Spill prevention and response plans describe the operational procedures to reduce the risks of spills and accidental discharge and ensure that proper controls are in place in the event they do occur. Spill prevention plans standardize everyday procedures and rely on employee training to reduce potential liability, fines and costs associated with clean up. Planning begins with an analysis of how pollutants are handled at the site and how they interact with storm water. Spill prevention and response plans have five major components:

1. A site map and evaluation of past spills and leaks
2. An inventory of materials at the site
3. Identification of potential spill areas
4. A list of required spill response equipment
5. Employee training

When spills do occur, a good spill prevention and response plan will clearly:

- Identify potential spill sites and their drainage points
- Specify material handling procedures
- Describe spill response procedures
- Ensure that adequate spill clean-up equipment is available

Employee Training

Effective and repeated employee training is essential to maintain pollution prevention practices at generating sites. Indeed, continuous employee training is an essential component of any pollution prevention plan, particularly at generating sites where the work force turns over frequently. Many businesses perceive time devoted to pollution prevention training as reducing their bottom line, and may be hesitant to develop training materials or allocate time for training. In some cases, local agencies supply free or low cost videos, posters, shop signs, or training brochures (often in multilingual formats). In other cases, short training classes are offered for employees or supervisors that are scheduled for down times of the year (e.g., winter classes for landscaping companies or construction contractors) or coincide with regular employee safety meetings.



Figure 18: Spill response often involves portable booms and pumps

Program managers can refer to Schueler *et al.* (2004) for more guidance on developing effective pollution practices at generating sites and storm water hotspots. Employee training should be conducted at least annually to educate workers on the proper practices to avoid illicit discharges and respond to spills. Training can be reinforced with signs, and posters.

Site Inspections

Regular inspections of generating sites are a key tool to foster pollution prevention and reduce the risk of illicit discharges. Communities that possess an MS4 permit should ensure that they have the authority to inspect non-regulated sites that connect to the municipal storm drain system they operate. These inspections can be used to assess the site and educate owners/operators about recommended pollution prevention practices. Site inspections are staff intensive and therefore are best suited to high-risk generating sites.

An industrial NPDES storm water permit is an extremely important compliance tool at many generating sites. NPDES permits require operators to prepare a pollution prevention plan for the site and implement the practices specified in the plan. Significant penalties can be imposed for non-compliance.

To date, compliance with the industrial storm water permit program has been spotty, and a significant fraction of regulated industries has failed to file their required permits. According to Duke and Shaver (1999) and Pronold (2000), as many as 50% of industrial sites that are required to have a permit do not actually have one. These sites are termed “non-filers,” and are often small businesses or operations that are unaware of the relatively new regulations. It is therefore quite likely that many hotspots in a subwatershed may not

have a valid NPDES permit. These operations should be educated about the industrial permit program, and encouraged to apply for permit coverage. Non-filers should be referred to the NPDES permitting authority for details on how to obtain permit coverage.

Inspections are an important stick to improve compliance at generating sites subject to industrial NPDES permits. Inspectors should frequently observe site operations to ensure that the right mix of pollution prevention practices is routinely employed. Communities with MS4 permits have the authority to inspect storm water NPDES sites that discharge to their storm drain system, and refer any violations for subsequent state or federal enforcement.

Voluntary inspections of non-regulated generating sites are a good tool to educate owners/operators about recommended pollution prevention practices. When generating sites are inspected, existing fire, building or health inspectors should be considered since they are already acquainted with how to deal with small businesses.

9.5 Preventing Illicit Discharges from Municipal Operations

Many municipal operations and services have the potential to create or reduce illicit discharges. Program managers should review all municipal operations and services to make sure good housekeeping is practiced. In addition, program managers should examine:

- Routine sewer and storm drain maintenance
- Plumbing code revisions
- HHW collection services
- Used motor oil collection services

Routine Sewer And Storm Drain Maintenance

Failure to regularly inspect and maintain local sewer and storm water infrastructure can cause illicit discharges to receiving waters. Within the storm drain system, maintenance should focus on frequent cleaning to keep trash, debris and illegally dumped material from entering the storm drain system. In the sanitary sewer network, maintenance should focus on finding damaged infrastructure that allows sewage discharges from the sanitary sewer. In-stream monitoring, historical data reviews of past complaints, or aging sewer infrastructure can often be used to identify likely problem areas.⁸

Plumbing Code Revisions

Communities need to establish the legal authority to prohibit illicit connections to the storm drain system. When the illicit discharge ordinance is being prepared, communities should thoroughly review all of their plumbing codes to prevent any misinterpretation that might create cross connections to the storm drain system. Program managers should also specifically target licensed plumbers to educate them on any code changes.

Household Hazardous Waste Collection Services

Households generate a lot of hazardous wastes, and communities need to educate residents about proper household hazardous waster (HHW) handling and disposal, and provide convenient options for pick up and disposal. Communities have experimented

with several innovative ways to deal with HHW including:

- A permanent facility that accepts HHW year-round and can serve as a central location for HHW exchange and recycling
- Mobile collection at temporary facilities. On designated special collection days, mobile units can move through communities accepting HHW and take the form of curbside pickup or central collection locations
- Some local businesses may act as drop off centers for certain products. Some local garages, for example, may accept used motor oil for recycling

Overall, the costs for implementing HHW collection programs can be high. Factors such as frequency of the collection, size of community, environmental awareness, level of staff training, and level of outreach all contribute to the overall cost. Participation in collection programs usually ranges from 1% to 5% of the population (HGAC, 2001), and the cost per participant can vary greatly (Table 28).

Used Motor Oil Collection Services

Used motor oil collection has been a common municipal service for many years, however, program managers may need to refine their programs to increase participation. Suggested outreach approaches include:

- Conventional outreach materials provided at points of sale (e.g., auto parts stores, service stations)
- Multilingual outreach materials
- Directories of used oil collection stations
- Free or discounted oil disposal containers

⁸ Preliminary sewer system investigations are not discussed further in this manual. For more detail on how to conduct these investigations consult the EPA handbook, "Sewer System Infrastructure Analysis and Rehabilitation." (U.S. EPA, 1991)

CASE STUDY

The City of Denver operates a pilot, door-to-door collection program to assist residents in the proper disposal and recycling of HHW. To be eligible for collection, residents must currently be receiving trash collection service from City Solid Waste Management crews. Residents are permitted one HHW collection annually and are asked to have at least three different materials before calling for a pickup. Residents then receive a collection date and an HHW Kit that holds up to 75 pounds. Residents are instructed on what items can be placed inside the Kit, and can have additional items picked up for a small fee. The program also educates citizens on how to prevent the accumulation of chemicals in the home environment. The key element of this service is convenience for area residents. Customers can make a phone call, put their waste in a container, and schedule a pickup (City of Denver, 2003).

Table 28: Summary of Local Household Hazardous Waste Collection Programs

Location	Budget	Households Served	Participants	Cost per Participant	Program Description
Fort Worth TX (2002)	\$937,740	26 cities	15,629	\$60	Accept 3 days a week at permanent facility, plus approx 24 mobile units
Monmouth County, NJ (2002)	\$900,000	620,000	6,200	\$145.16	Permanent facility plus 2-3 remote days
Nashville, TN (2002)	\$149,000	180,000	5,800	\$26	361 day drop off at permanent facility
Putnam County, NY (1997)	\$20,279	27,409	349	\$58.10	One collection day per year
Town of East Hampton, NY (1997)	\$36,495	4,878	452	\$80	Three collection days per year

CASE STUDY

Municipal cross-training is a proven and effective tool for identifying illicit discharges. Wayne County, Michigan has a very active IDDE program that has included efforts to train all County "field" staff to identify and report suspicious discharges in the course of their duties. The Illicit Discharge Elimination Training Program includes presentations for general field staff that instructs them in the identification and reporting of suspicious discharges. To date, 734 people from various agencies and communities throughout Michigan have attended the training sessions (Tuomari and Thompson, 2002).

The information these individuals gained from attending the training session helped identify 82 illicit discharges in the counties of Oakland, Washtenaw, and Wayne. Road division staff trained in recognizing illicit discharges discovered 12 septic systems in Wayne County that were failing or had direct discharges to surface water. Other counties found 70 illicit discharges during their investigations. The elimination of these illicit discharges will prevent an estimated 3.5 million gallons of polluted water from reaching Michigan surface waters each year (associated load reductions are estimated at 7,200 pounds/year of Biological Oxygen Demand and 25,000 lbs/yr of Total Suspended Solids)

9.6 Budgeting and Scoping Pollution Prevention

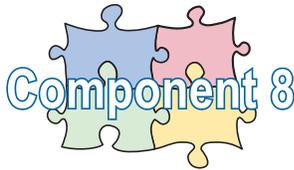
The cost of preventing illicit discharges is directly related to the scope of the education effort. Larger communities often employ education staff on a full-time basis, or at least have one staff member who spends much of their time doing outreach on issues such as illicit discharges. Smaller communities often spread the education effort out over several departments, and try to use already established programs such as

cooperative extensions or citizen watershed groups. Table 29 provides some cost data for storm water education in one community.

In reality, program managers have to do a lot of homework to scope and budget their pollution prevention education program. Normally, these education efforts are integrated with other storm water education programs. One of the best tools to develop an overall education budget is the Source Control Plan, which is described in Schueler *et al.* (2004).

Table 29: Estimated Costs for Public Awareness Program Components
(Adapted from Wayne County, MI, 2001)

Education Component	Estimated Cost	Assumptions
Information Brochures	\$100/hour for development \$0.10-\$0.20/pamphlet for black and white printing \$0.30/pamphlet for mailing	160-320 hours
Technical Manuals	\$100/hour for development \$100.00/manual for printing	160-480 hours
Business Education	\$50/hour for business/activity list \$100/hour for development \$50/hour for employee presentation	40-80 hours for compilation 80-160 hours for development. 8 hours for presentation, including prep time.
Program Planning and Administration	\$10,000 per year	0.2 Full Time Equivalents (FTE) per year
Source: Wayne County, MI, 2001. <i>Planning and Cost Estimating Criteria for Best Management Practices. Rouge River Wet Weather Demonstration Project. TR-NPS25.00</i>		



Chapter 10: IDDE Program Tracking and Evaluation

Purpose: This last program component addresses the ongoing management of the IDDE program and reviews progress made in meeting the measurable program goals established earlier in the permit cycle. Adaptive management is critical since most communities initially have a poor understanding of the scope and nature of their illicit discharge problem. Frequent program review can ensure that the most severe illicit discharges are eliminated in the most cost-effective way during the permit cycle. Program evaluation should also be directly tied to program goals (see Chapter 6 on Developing Program Goals and Implementation Strategy)

Method(s): The primary method is frequent maintenance and analysis of the IDDE tracking system developed as part of the program. The integrated tracking system contains geospatial data on ORI results, indicator monitoring, on-site investigations, dumping and spill sites and hotline calls. The tracking system is important from both an enforcement and program evaluation standpoint. Each of the eight program components should be reviewed annually and prior to new permit negotiation, using data collected, compiled, and assessed from the tracking system.

Desired Product or Outcome(s): Updated tracking database and annual report with summary of progress to date, findings, recommendations for program revisions, and work plan (including milestones and goals) for the upcoming year.

Budget and/or Staff Resources Required: Program assessment is an ongoing responsibility of the program manager. The staff effort to prepare an annual report is about three to four weeks. In general, the first annual report will require more effort than subsequent ones.

Integration with Other Programs: Program managers should always consider other programs and regulatory requirements when assessing program performance and revising goals. At a minimum, the annual report should be shared with other departments and agencies to head off duplication of efforts and to look for opportunities to pool resources.

10.1 Establish a Tracking and Reporting System

An accurate and user-friendly system to track, report and respond to illicit discharge problems is critical for program managers. Ideally, the tracking system should be designed and operational within the first year of the program. The tracking system enables managers to measure program indicators, and gives field crews a home to store the data they collect. The ideal tracking system consists of a relational database that is linked to a GIS system, which can be used to store and analyze data and produce maps.

The fundamental units to track are individual outfalls, along with any supporting information about their contributing drainage area. Some of the key information to include when tracking outfalls includes:

- Geospatial coordinates of each outfall location
- The subwatershed and watershed address
- Any supporting information about the contributing land use
- Diameter and physical characteristics of the outfall
- Outfall Reconnaissance Inventory (ORI) data, as it is collected
- Any accompanying digital photos
- Any follow-up monitoring at the outfall or further up the pipe
- Any hotline complaints logged for the outfall, along with the local response
- Status and disposition of any enforcement actions
- Maintenance and inspection data

10.2 Evaluate the Program

Since IDDE programs are a first time endeavor for many communities, program managers need to be extremely adaptable in how they allocate their resources. Effective IDDE programs are dynamic and flexible to respond to an ever-changing set of discharge problems, program obstacles, and emerging technologies. At a minimum, program managers should maintain and evaluate their IDDE tracking system annually, and modify program components as needed. Tracking systems should be designed so that progress toward measurable goals (see Chapter 6) can be easily reported. Communities that develop and maintain a comprehensive tracking system should realize program efficiencies. The tracking system should contain the following features at a minimum:

- Updated mapping to reflect outfalls located during the ORI
- Surveyed stream reaches with locations of obvious, suspect, and potential discharges, and locations of dumping sites
- Indicator sampling results for specific streams, outfalls and storm drains
- Frequency of hotline use and associated number of “hits” or confirmed illicit discharges
- Costs for each of the eight program components (e.g., office, field, lab, education, enforcement, etc.)
- Number of discharges corrected
- Status and disposition of enforcement actions

Regular analysis of the tracking system sheds light on program strengths and

deficiencies, and improves targeting of limited program resources. For example, if hotline complaints are found to uncover the most severe illicit discharge problems, program managers may want to allocate more resources to increase public awareness about the hotline, and shift resources from outfall screening and indicator monitoring.

Chapter 11: The Outfall Reconnaissance Inventory

This chapter describes a simple field assessment known as the Outfall Reconnaissance Inventory (ORI). The ORI is designed to fix the geospatial location and record basic characteristics of individual storm drain outfalls, evaluate suspect outfalls, and assess the severity of illicit discharge problems in a community. Field crews should walk all natural and man-made streams channels with perennial and intermittent flow, even if they do not appear on available maps (Figure 19). The goal is to complete the ORI on every stream mile in the MS4 within the first permit cycle, starting with priority subwatersheds identified during the desktop analysis. The results of the ORI are then used to help guide future outfall monitoring and discharge prevention efforts.

11.1 Getting Started

The ORI requires modest mapping, field equipment, staffing and training resources. A complete list of the required and optional resources needed to perform an ORI is presented in Table 30. The ORI can be combined with other stream assessment



Figure 19: Walk all streams and constructed open channels

tools, and may be supplemented by simple indicator monitoring. Ideally, a Phase II community should plan on surveying its entire drainage network at least once over the course of each five-year permit cycle. Experience suggests that it may take up to three stream walks to identify all outfalls.

Best Times to Start

Timing is important when scheduling ORI field work. In most regions of the country, spring and fall are the best seasons to perform the ORI. Other seasons typically have challenges such as over-grown vegetation or high groundwater that mask illicit discharges, or make ORI data hard to interpret⁹.

Prolonged dry periods during the non-growing season with low groundwater levels are optimal conditions for performing an ORI. Table 31 summarizes some of the regional factors to consider when scheduling ORI surveys in your community. Daily weather patterns also determine whether ORI field work should proceed. In general, ORI field work should be conducted at least 48 hours after the last runoff-producing rain event.

Field Maps

The field maps needed for the ORI are normally generated during the desktop assessment phase of the IDDE program described in Chapter 5. This section

⁹ Upon initial program start-up, the ORI should be conducted during periods of low groundwater to more easily identify likely illicit discharges. However, it should be noted that high water tables can increase sewage contamination in storm drain networks due to infiltration and inflow interactions. Therefore, in certain situations, seasonal ORI surveys may be useful at identifying these types of discharges. Diagnosis of this source of contamination, however, can be challenging.

Table 30: Resources Needed to Conduct the ORI		
Need Area	Minimum Needed	Optional but Helpful
Mapping	<ul style="list-style-type: none"> • Roads • Streams 	<ul style="list-style-type: none"> • Known problem areas • Major land uses • Outfalls • Specific industries • Storm drain network • SIC-coded buildings • Septics
Field Equipment	<ul style="list-style-type: none"> • 5 one-liter sample bottles • Backpack • Camera (preferably digital) • Cell phones or hand-held radios • Clip boards and pencils • Field sheets • First aid kit • Flash light or head lamp • GPS unit • Spray paint (or other marker) • Surgical gloves • Tape measure • Temperature probe • Waders (snake proof where necessary) • Watch with a second hand 	<ul style="list-style-type: none"> • Portable Spectrophotometer and reagents (can be shared among crews) • Insect repellent • Machete/clippers • Sanitary wipes or biodegradable soap • Wide-mouth container to measure flow • Test strips or probes (e.g., pH and ammonia)
Staff	<ul style="list-style-type: none"> • Basic training on field methodology • Minimum two staff per crew 	<ul style="list-style-type: none"> • Ability to track discharges up the drainage system • Knowledge of drainage area, to identify probable sources. • Knowledge of basic chemistry and biology

Table 31: Preferred Climate/Weather Considerations for Conducting the ORI		
Preferred Condition	Reason	Notes/Regional Factors
Low groundwater (e.g., very few flowing outfalls)	High groundwater can confound results	In cold regions, do not conduct the ORI in the early spring, when the ground is saturated from snowmelt.
No runoff-producing rainfall within 48 hours	Reduces the confounding influence of storm water	The specific time frame may vary depending on the drainage system.
Dry Season	Allows for more days of field work	Applies in regions of the country with a “wet/dry seasonal pattern.” This pattern is most pronounced in states bordering or slightly interior to the Gulf of Mexico or the Pacific Ocean.
Leaf Off	Dense vegetation makes finding outfalls difficult	Dense vegetation is most problematic in the southeastern United States. This criterion is helpful but not required.

provides guidance on the basic requirements for good field maps. First, ORI field maps do not need to be fancy. The scale and level of mapping detail will vary based on preferences and navigational skills of field crews. At a minimum, maps should have labeled streets and hydrologic features (USGS blue line streams, wetlands, and lakes), so field crews can orient themselves and record their findings spatially.

Field maps should delineate the contributing drainage area to major outfalls, but only if they are readily available. Urban landmarks such as land use, property boundaries, and storm drain infrastructure are also quite useful in the field. ORI field maps should be used to check the accuracy and quality of pre-existing mapping information, such as the location of outfalls and stream origins.

Basic street maps offer the advantage of simplicity, availability, and well-labeled road networks and urban landmarks. Supplemental maps such as a 1": 2000' scale USGS Quad sheet or finer scale aerial photograph are also recommended for the field. USGS Quad sheets are readily available and display major transportation networks and landmarks, "blue line" streams, wetlands, and topography. Quad maps may be adequate for less developed subwatersheds, but are not always accurate in more urban subwatersheds.

Recent aerial photographs may provide the best opportunity to navigate the subwatershed and assess existing land cover. Aerial photos, however, may lack topography and road names, can be costly, and are hard to record field notes on due to their darkness. GIS-ready aerial photos and USGS Quad sheets can be downloaded from the internet or obtained from local planning, parks, or public works agencies.

Field Sheets

ORI field sheets are used to record descriptive and quantitative information about each outfall inventoried in the field. Data from the field sheets represent the building blocks of an outfall tracking system allowing program managers to improve IDDE monitoring and management. A copy of the ORI field sheet is provided in Appendix D, and is also available as a Microsoft Word™ document. Program managers should modify the field sheet to meet the specific needs and unique conditions in their community.

Field crews should also carry an authorization letter and a list of emergency phone numbers to report any emergency leaks, spills, obvious illicit discharges or other water quality problems to the appropriate local authorities directly from the field. Local law enforcement agencies may also need to be made aware of the field work. Figure 20 shows an example of a water pollution emergency contact list developed by Montgomery County, MD.

Equipment

Basic field equipment needed for the ORI includes waders, a measuring tape, watch, camera, GPS unit, and surgical gloves (see Table 30). GPS units and digital cameras are usually the most expensive equipment items; however, some local agencies may already have them for other applications. Adequate ranging, water-resistant, downloadable GPS units can be purchased for less than \$150. Digital cameras are preferred and can cost between \$200 and \$400, however, conventional or disposable cameras can also work, as long as they have flashes. Hand-held data recorders and customized software can be used to record text, photos, and GPS coordinates electronically in the field. While

these technologies can eliminate field sheets and data entry procedures, they can be quite expensive. Field crews should always carry basic safety items, such as cell phones, surgical gloves, and first aid kits.

Staffing

The ORI requires at least a two-person crew, for safety and logistics. Three person crews provide greater safety and flexibility, which helps divide tasks, allows one person to assess adjacent land uses, and facilitates tracing outfalls to their source. All crew members should be trained on how to complete the ORI and should have a basic understanding of illicit discharges and their water quality impact. ORI crews can be staffed by trained volunteers, watershed groups and college interns. Experienced crews can normally expect to cover two to three stream miles per day, depending on stream access and outfall density.

11.2 Desktop Analysis to Support the ORI

Two tasks need to be done in the office before heading out to the field. The major ORI preparation tasks include estimating the total stream and channel mileage in the subwatershed and generating field maps. The total mileage helps program managers scope out how long the ORI will take and how much it will cost. As discussed before, field maps are an indispensable navigational aid for field crews working in the subwatershed.

Delineating Survey Reaches

ORI field maps should contain a preliminary delineation of **survey reaches**. The stream network within your subwatershed should be delineated into discrete segments of relatively uniform character. Delineating survey reaches provides good stopping and starting points for field crews, which

COUNTY AGENCIES		INTER-COUNTY AGENCIES	
DEP: Department of Environmental Protection	MNCPPC: Maryland-National Capital Park & Planning Commission	WSSC: Washington Suburban Sanitary Commission	
DEPC: Division of Environmental Policy & Compliance			
WMD: Watershed Management Division			
DPS: Department of Permitting Services	DHCD: Department of Housing & Community Development		
LDS: Land Development Services			
SWM: Stormwater Management	DPWT: Department of Public Works & Transportation		
WS: Wells & Septic			
PROBLEM/QUESTION		AGENCY & TELEPHONE NUMBER	
ILLEGAL DUMPING HOTLINE		DEPC: 240-777-7700 Daytime hours ←	
		→ Nighttime hours 240/777-DUMP (3867) or 240-777-7788	
Blocked storm drain, inlet or pipe or erosion from public storm drain	DPWT: 240/777-ROAD (7623) Highway Maintenance)		
Discolored public drinking water, odor to drinking water	301/206-4002		
Erosion, flooding, drainage problems between private properties	DHCD: 240/777-3600		
	(Code Enforcement)		
Erosion - stream banks on park land	MNCPPC: 301/495-2535		
Fire & Rescue Services (emergencies: 911)	(Non-Emergencies): 240/777-0744		
Recycling Programs/Special pick up services	DPWT: 240/777-6400 or 6486		
Sanitary sewer problems	WSSC: 301/206-4002		
Sediment (mud) from construction site entering streams	LDS: 240/777-6366		
Septic Leaks/ Septic Tanks	WS: 240/777-6300		
Stormwater Management, pond safety and maintenance	DEPC: 240/777-7744		
Stormwater Management and Sediment Control Plan Review Issues	SWM: 240/777-6320		
Stream Clean-ups	WMD: 240/777-7712		
Swimming Pool Discharges	DEPC: 240/777-7770		
Trash and debris in parks and streams	MNCPPC: 301/495-2535		
Water main break	WSSC: 301/206-4002		
Water pollution	DEPC: 240/777-7770		
(discharging, dumping, chemical spills into streams or storm drains)	LDS: 240/777-6260		
Water quality monitoring programs for schools (Stream Teams)	WMD: 240/777-7714		
Wells and Well Inspections	WS: 240/777-6300		

Figure 20: Example of a comprehensive emergency contact list for Montgomery County, MD

is useful from a data management and logistics standpoint. Each survey reach should have its own unique identifying number to facilitate ORI data analysis and interpretation. Figure 21 illustrates some tips for delineating survey reaches, and additional guidance is offered below:

- Survey reaches should be established above the confluence of streams and between road crossings that serve as a convenient access point.
- Survey reaches should be defined at the transition between major changes in land use in the stream corridor (e.g. forested land to commercial area).
- Survey reaches should generally be limited to a quarter mile or less in length. Survey reaches in lightly

developed subwatersheds can be longer than those in more developed subwatersheds, particularly if uniform stream corridor conditions are expected throughout the survey reach.

- Access through private or public property should be considered when delineating survey reaches as permission may be required.

It should be noted that initial field maps are not always accurate, and changes may need to be made in the field to adjust survey reaches to account for conditions such as underground streams, missing streams or long culverts. Nevertheless, upfront time invested in delineating survey reaches makes it easier for field crews to perform the ORI.



Figure 21: Various physical factors control how survey reaches are delineated. (a) Survey reaches based on the confluence of stream tributaries. (b) A long tributary split into $\frac{1}{4}$ mile survey reaches.

(c) Based on a major road crossing (include the culvert in the downstream reach). (d) Based on significant changes in land use (significant changes in stream features often occur at road crossings, and these crossings often define the breakpoints between survey reaches).

11.3 Completing the ORI

Field crews conduct an ORI by walking all streams and channels to find outfalls, record their location spatially with a GPS unit and physically mark them with spray paint or other permanent marker. Crews also photograph each outfall and characterize its dimensions, shape, and component material, and record observations on basic sensory and physical indicators. If dry weather flow occurs at the outfall, additional flow and water quality data are collected. Field crews may also use field probes or test strips to measure indicators such as temperature, pH, and ammonia at flowing outfalls.

The ORI field sheet is divided into eight sections that address both flowing and non-flowing outfalls (Appendix D). Guidance on completing each section of the ORI field sheet is presented below.

Outfalls to Survey

The ORI applies to **all** outfalls encountered during the stream walk, regardless of diameter, with a few exceptions noted in Table 32. Common outfall conditions seen in communities are illustrated in Figure 22. As a rule, crews should only omit an outfall if they can definitively conclude it has no potential to contribute to a transitory illicit discharge. While EPA’s Phase I guidance only targeted major outfalls (diameter of 36 inches or greater), documenting all outfalls is recommended, since smaller pipes make up the majority of all outfalls and frequently have illicit discharges (Pitt *et al.*, 1993 and Lalor, 1994). A separate ORI field sheet should be completed for each outfall.

Outfalls to Record	Outfalls to Skip
<ul style="list-style-type: none"> • Both large and small diameter pipes that appear to be part of the storm drain infrastructure • Outfalls that appear to be piped headwater streams • Field connections to culverts • Submerged or partially submerged outfalls • Outfalls that are blocked with debris or sediment deposits • Pipes that appear to be outfalls from storm water treatment practices • Small diameter ductile iron pipes • Pipes that appear to only drain roof downspouts but that are subsurface, preventing definitive confirmation 	<ul style="list-style-type: none"> • Drop inlets from roads in culverts (unless evidence of illegal dumping, dumpster leaks, etc.) • Cross-drainage culverts in transportation right-of-way (i.e., can see daylight at other end) • Weep holes • Flexible HDPE pipes that are known to serve as slope drains • Pipes that are clearly connected to roof downspouts via above-ground connections

 <p>Ductile iron round pipe</p>	 <p>4-6" HDPE; Check if roof leader connection (legal)</p>	 <p>Field connection to inside of culvert; Always mark and record.</p>
 <p>Small diameter (<2") HDPE; Often a sump pump (legal), or may be used to discharge laundry water (illicit).</p>	 <p>Elliptical RCP; Measure both horizontal and vertical diameters.</p>	 <p>Double RCP round pipes; Mark as separate outfalls unless known to connect immediately up-pipe</p>
 <p>Culvert (can see to other side); Don't mark as an outfall</p>	 <p>Open channel "chute" from commercial parking lot; Very unlikely illicit discharge. Mark, but do not return to sample (unless there is an obvious problem).</p>	 <p>Small diameter PVC pipe; Mark, and look up-pipe to find the origin.</p>
 <p>CMP outfall; Crews should also note upstream sewer crossing.</p>	 <p>Box shaped outfall</p>	 <p>CMP round pipe with two weep holes at bridge crossing. (Don't mark weep holes)</p>

Figure 22: Typical Outfall Types Found in the Field

Obvious Discharges

Field crews may occasionally encounter an obvious illicit discharge of sewage or other pollutants, typified by high turbidity, odors, floatables and unusual colors. When obvious discharges are encountered, field crews should STOP the ORI survey, track down the source of the discharge and immediately contact the appropriate water pollution agency for enforcement. Crews should photo-document the discharge, estimate its flow volume and collect a sample for water quality analysis (if this can be done safely). All three kinds of evidence are extremely helpful to support subsequent enforcement. Chapter 13 provides details on techniques to track down individual discharges.

11.4 ORI Section 1 - Background Data

The first section of the ORI field sheet is used to record basic data about the survey, including time of day, GPS coordinates for the outfall, field crew members, and current

and past weather conditions (Figure 23). Much of the information in this section is self-explanatory, and is used to create an accurate record of when, where, and under what conditions ORI data were collected.

Every outfall should be photographed and marked by directly writing a unique identifying number on each outfall that serves as its subwatershed “address” (Figure 24). Crews can use spray paint or another temporary marker to mark outfalls, but may decide to replace temporary markings with permanent ones if the ORI is repeated later. Markings help crews confirm outfall locations during future investigations, and gives citizens a better way to report the location of spills or discharges when calling a water pollution hotline. Crews should mark the spatial location of all outfalls they encounter directly on field maps, and record the coordinates with a GPS unit that is accurate to within 10 feet. Crews should take a digital photo of each outfall, and record photo numbers in Section 1 of the field sheet.

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.):	Last 24 hours:	Last 48 hours:
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	
Land Use in Drainage Area (Check all that apply):			
<input type="checkbox"/> Industrial	<input type="checkbox"/> Open Space		
<input type="checkbox"/> Ultra-Urban Residential	<input type="checkbox"/> Institutional		
<input type="checkbox"/> Suburban Residential	Other: _____		
<input type="checkbox"/> Commercial	Known Industries: _____		
Notes (e.g., origin of outfall, if known):			

Figure 23: Section 1 of the ORI Field Sheet



Figure 24: Labeling an outfall (a variety of outfall naming conventions can be used)

The land use of the drainage area contributing to the outfall should also be recorded. This may not always be easy to characterize at

large diameter outfalls that drain dozens or even hundreds of acres (unless you have aerial photographs). On the other hand, land use can be easily observed at smaller diameter outfalls, and in some cases, the specific origin can be found (e.g., a roof leader or a parking lot; Figure 25). The specific origin should be recorded in the “notes” portion of Section 1 on the field sheet.

11.5 ORI Section 2 - Outfall Description

This part of the ORI field sheet is where basic outfall characteristics are noted (Figure 26). These include material, and presence of flow at the outfall, as well as the pipe’s dimensions (Figure 27). These measurements are used to confirm and supplement existing storm drain maps (if they are available). Many communities only map storm drain outfalls that exceed a given pipe diameter, and may not contain data on the material and condition of the pipe.



Figure 25: The origin of this corrugated plastic pipe was determined to be a roof leader from the house up the hill.

Section 2 of the field sheet also asks if the outfall is submerged in water or obstructed by sediment and the amount of flow, if present. Figure 28 provides some photos that illustrate how to characterize relative

submergence, deposition and flow at outfalls. If no flow is observed at the outfall, you can skip the next two sections of the ORI field sheet and continue with Section 5.

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE	DIMENSIONS (IN.)	SUBMERGED
<input type="checkbox"/> Closed Pipe	<input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____	<input type="checkbox"/> Circular <input type="checkbox"/> Single <input type="checkbox"/> Elliptical <input type="checkbox"/> Double <input type="checkbox"/> Box <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	Diameter/Dimensions: _____	In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open drainage	<input type="checkbox"/> Concrete <input type="checkbox"/> Earthen <input type="checkbox"/> rip-rap <input type="checkbox"/> Other: _____	<input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____	Depth: _____ Top Width: _____ Bottom Width: _____	
<input type="checkbox"/> In-Stream	(applicable when collecting samples)			
Flow Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No		<i>If No, Skip to Section 5</i>	
Flow Description (If present)	<input type="checkbox"/> Trickle <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial			

Figure 26: Section 2 of the ORI Field Sheet



Figure 27: Measuring Outfall Diameter



Figure 28: Characterizing Submersion and Flow

11.6 ORI Section 3 - Quantitative Characterization for Flowing Outfalls

This section of the ORI records direct measurements of **flowing outfalls**, such as flow, temperature, pH and ammonia (Figure 29). If desired, additional water quality

parameters can be added to this section. Chapter 12 discusses the range of water quality parameters that can be used.

Field crews measure the rate of flow using one of two techniques. The first technique simply records the time it takes to fill a container of a known volume, such as a one liter sample bottle. In the second technique,

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER		RESULT	UNIT	EQUIPMENT
<input type="checkbox"/> Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
<input type="checkbox"/> Flow #2	Flow depth		In	Tape measure
	Flow width	____' ____"	Ft, In	Tape measure
	Measured length	____' ____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Thermometer
pH			pH Units	Test strip/Probe
Ammonia			mg/L	Test strip

Figure 29: Section 3 of the ORI Field Sheet

the crew measures the velocity of flow, and multiplies it by the estimated cross sectional area of the flow.

To use the flow volume technique, it may be necessary to use a “homemade” container to capture flow, such as a cut out plastic milk container that is marked to show a one liter volume. The shape and flexibility of plastic containers allows crews to capture relatively flat and shallow flow (Figure 30). The flow volume is determined as the volume of flow captured in the container per unit time.

The second technique measures flow rate based on velocity and cross sectional area, and is preferred for larger discharges where containers are too small to effectively capture the flow (Figure 31). The crew measures and marks off a fixed flow length (usually about five feet), crumbles leaves or other light material, and drops them into the discharge (crews can also carry peanuts or ping pong balls to use). The crew then measures the time it takes the marker to travel across the length. The velocity of flow is computed as the length of the flow path (in feet) divided by the travel time (in seconds). Next, the cross-sectional flow area is measured by taking multiple readings of the depth and width of flow. Lastly, cross-

sectional area (in square feet) is multiplied by flow velocity (feet/second) to calculate the flow rate (in cubic feet/second).

Crews may also want to measure the quality of the discharge using relatively inexpensive probes and test strips (e.g., water temperature, pH, and ammonia). The choice of which indicator parameters to measure is usually governed by the overall IDDE monitoring framework developed by the community. Some communities have used probes or test strips to measure additional indicators such as conductivity, chlorine, and hardness. Research by Pitt (for this project) suggests that probes by Horiba for pH and conductivity are the most reliable and



Figure 30: Measuring flow (as volume per time)

accurate, and that test strips have limited value.

When probes or test strips are used, measurements should be made from a sample bottle that contains flow captured from the outfall. The exact measurement recorded by the field probe should be recorded in Section 3 of the field sheet. Some interpolation may be required for test strips, but do not interpolate further than the mid-range between two color points.

11.7 ORI Section 4 – Physical Indicators for Flowing Outfalls Only

This section of the ORI field sheet records data about four sensory indicators associated with **flowing outfalls**—odor, color, turbidity and floatables (Figure 32). Sensory indicators can be detected by smell or sight, and require no measurement equipment. Sensory indicators do not always reliably predict illicit discharge, since the senses can be fooled, and may result in a “false negative” (i.e., sensory indicators fail to detect an illicit discharge when one is actually present). Sensory indicators are important, however, in detecting the most severe or obvious discharges. Section 4 of the field sheet asks whether the sensory indicator is present, and if so, what is its severity, on a scale of one to three.

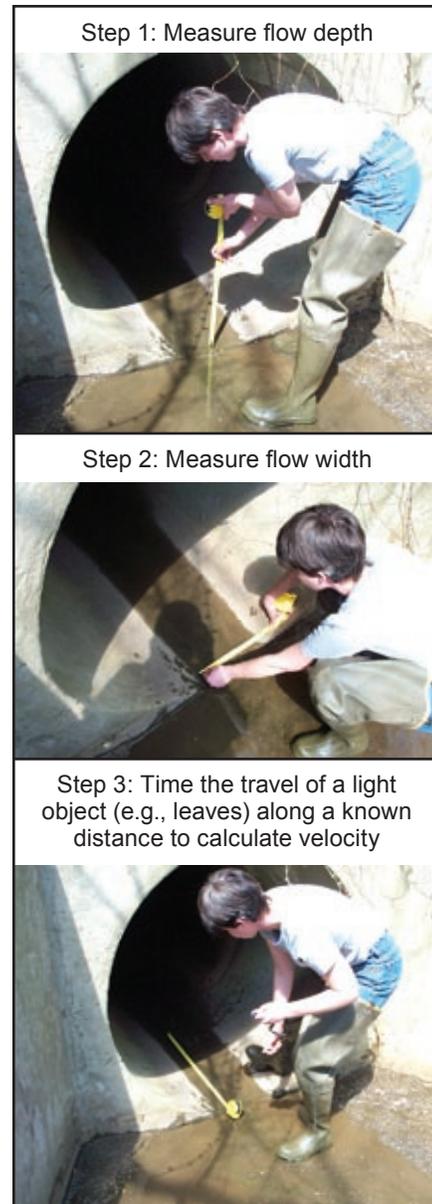


Figure 31: Measuring flow (as velocity times cross-sectional area)

Section 4: Physical Indicators for Flowing Outfalls Only
 Are Any Physical Indicators Present in the flow? Yes No (If No, Skip to Section 5)

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX M(1-3)		
			1	2	3
Odor	<input type="checkbox"/>	<input type="checkbox"/> Sewage <input type="checkbox"/> Rancid/sour <input type="checkbox"/> Petroleum/gas <input type="checkbox"/> Sulfide <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint	<input type="checkbox"/> 2 – Easily detected	<input type="checkbox"/> 3 – Noticeable from a distance
Color	<input type="checkbox"/>	<input type="checkbox"/> Clear <input type="checkbox"/> Brown <input type="checkbox"/> Gray <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Orange <input type="checkbox"/> Red <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint colors in sample bottle	<input type="checkbox"/> 2 – Clearly visible in sample bottle	<input type="checkbox"/> 3 – Clearly visible in outfall flow
Turbidity	<input type="checkbox"/>	See severity	<input type="checkbox"/> 1 – Slight cloudiness	<input type="checkbox"/> 2 – Cloudy	<input type="checkbox"/> 3 – Opaque
Floatables -Does Not Include Trash!!	<input type="checkbox"/>	<input type="checkbox"/> Sewage (Toilet Paper, etc.) <input type="checkbox"/> Suds <input type="checkbox"/> Petroleum (oil sheen) <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Few/slight; origin not obvious	<input type="checkbox"/> 2 – Some; indications of origin (e.g., possible suds or oil sheen)	<input type="checkbox"/> 3 – Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Figure 32: Section 4 of the ORI Field Sheet

Odor

Section 4 asks for a description of any odors that emanate from the outfall and an associated severity score. Since noses have different sensitivities, the entire field crew should reach consensus about whether an odor is present and how severe it is. A severity score of one means that the odor is faint or the crew cannot agree on its presence or origin. A score of two indicates a moderate odor within the pipe. A score of three is assigned if the odor is so strong that the crew smells it a considerable distance away from the outfall.

TIP

Make sure the origin of the odor is the outfall. Sometimes shrubs, trash or carrion, or even the spray paint used to mark the outfall can confuse the noses of field crews.

Color

The color of the discharge, which can be clear, slightly tinted, or intense is recorded next. Color can be quantitatively analyzed in the lab, but the ORI only asks for a visual assessment of the discharge color and its intensity. The best way to measure color is to collect the discharge in a clear sample bottle and hold it up to the light (Figure 33). Field crews should also look for downstream plumes of color that appear to be associated with the outfall. Figure 34 illustrates the spectrum of colors that may be encountered during an ORI survey, and offers insight on how to rank the relative intensity or strength of discharge color. Color often helps identify industrial discharges; Appendix K provides guidance on colors often associated with specific industrial operations.

Turbidity

The ORI asks for a visual estimate of the turbidity of the discharge, which is a measure of the cloudiness of the water. Like color, turbidity is best observed in a clear sample bottle, and can be quantitatively measured using field probes. Crews should also look for turbidity in the plunge pool below the outfall, and note any downstream turbidity plumes that appear to be related to the outfall. Field crews can sometimes confuse turbidity with color, which are related but are not the same. Remember, turbidity is a measure of how easily light can penetrate through the sample bottle, whereas color is defined by the tint or intensity of the color observed. Figure 34 provides some examples of how to distinguish turbidity from color, and how to rank its relative severity.



Figure 33: Using a sample bottle to estimate color and turbidity

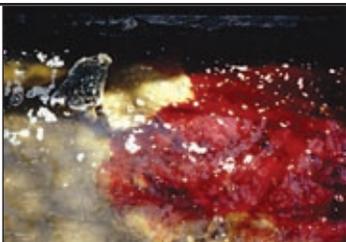
 <p>Color: Brown; Severity: 2 Turbidity Severity: 2</p>	 <p>Color: Blue-green; Severity: 3 Turbidity Severity: 2</p>	 <p>Highly Turbid Discharge Color: Brown; Severity: 3 Turbidity Severity: 3</p>
 <p>Sewage Discharge Color: 3 Turbidity: 3</p>	 <p>Paint Color: White; Severity: 3 Turbidity: 3</p>	 <p>Industrial Discharge Color: Green; Severity: 3 Turbidity Severity: 3</p>
 <p>Blood Color: Red; Severity: 3 Turbidity Severity: None</p>	 <p>Failing Septic System: Turbidity Severity: 3</p>	 <p>Turbidity in Downstream Plume Turbidity Severity: 2 (also confirm with sample bottle)</p>
 <p>High Turbidity in Pool Turbidity Severity: 2 (Confirm with sample bottle)</p>	 <p>Iron Floc Color: Reddish Orange; Severity: 3 (Often associated with a natural source)</p>	 <p>Slight Turbidity Turbidity: 1 (Difficult to interpret this observation; May be natural or an illicit discharge)</p>
<p>Construction Site Discharge Turbidity Severity: 3</p>		<p>Discharge of Rinse from Floor Sanding (Found during wet weather) Turbidity Severity: 3</p>

Figure 34: Interpreting Color and Turbidity

Floatables

The last sensory indicator is the presence of any floatable materials in the discharge or the plunge pool below. Sewage, oil sheen, and suds are all examples of floatable indicators; trash and debris are generally not in the context of the ORI. The presence of floatable materials is determined visually, and some guidelines for ranking their severity are provided in Figure 35, and described below.

If you think the floatable is sewage, you should automatically assign it a severity score of three since no other source looks quite like it. Surface oil sheens are ranked based on their thickness and coverage. In some cases, surface sheens may not be related to oil discharges, but instead are

created by in-stream processes, such as shown in Figure 36. A thick or swirling sheen associated with a petroleum-like odor may be diagnostic of an oil discharge.

Suds are rated based on their foaminess and staying power. A severity score of three is designated for thick foam that travels many feet before breaking up. Suds that break up quickly may simply reflect water turbulence, and do not necessarily have an illicit origin. Indeed, some streams have naturally occurring foams due to the decay of organic matter. On the other hand, suds that are accompanied by a strong organic or sewage-like odor may indicate a sanitary sewer leak or connection. If the suds have a fragrant odor, they may indicate the presence of laundry water or similar wash waters.

SUDS		
 <p>Natural Foam Note: Suds only associated with high flows at the “drop off” Do not record.</p>	 <p>Low Severity Suds Rating: 1 Note: Suds do not appear to travel; very thin foam layer</p>	 <p>High severity suds Rating: 3 Sewage</p>
OIL SHEENS		
 <p>Low Severity Oil Sheen Rating: 1</p>	 <p>Moderate Severity Oil Sheen Rating: 2</p>	 <p>High Severity Oil Film Rating: 3</p>

Figure 35: Determining the Severity of Floatables

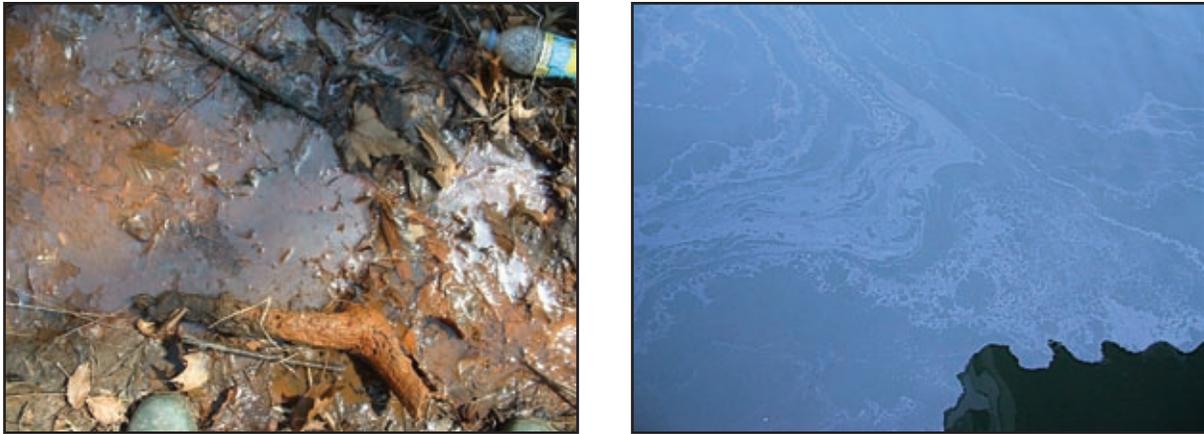


Figure 36: Synthetic versus Natural Sheen (a) Sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed (b) Synthetic oil forms a swirling pattern

11.8 ORI Section 5 - Physical Indicators for Both Flowing and Non-Flowing Outfalls

Section 5 of the ORI field sheet examines physical indicators found at both **flowing and non-flowing** outfalls that can reveal the impact of past discharges (Figure 37). Physical indicators include outfall damage, outfall deposits or stains, abnormal vegetation growth, poor pool quality, and benthic growth on pipe surfaces. Common

examples of physical indicators are portrayed in Figures 38 and 39. Many of these physical conditions can indicate that an intermittent or transitory discharge has occurred in the past, even if the pipe is not currently flowing. Physical indicators are not ranked according to their severity, because they are often subtle, difficult to interpret and could be caused by other sources. Still, physical indicators can provide strong clues about the discharge history of a storm water outfall, particularly if other discharge indicators accompany them.

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls
 Are physical indicators that are not related to flow present? Yes No (If No, Skip to Section 6)

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	<input type="checkbox"/>	<input type="checkbox"/> Spalling, Cracking or Chipping <input type="checkbox"/> Peeling Paint <input type="checkbox"/> Corrosion	
Deposits/Stains	<input type="checkbox"/>	<input type="checkbox"/> Oily <input type="checkbox"/> Flow Line <input type="checkbox"/> Paint <input type="checkbox"/> Other:	
Abnormal Vegetation	<input type="checkbox"/>	<input type="checkbox"/> Excessive <input type="checkbox"/> Inhibited	
Poor pool quality	<input type="checkbox"/>	<input type="checkbox"/> Odors <input type="checkbox"/> Colors <input type="checkbox"/> Floatables <input type="checkbox"/> Oil Sheen <input type="checkbox"/> Suds <input type="checkbox"/> Excessive Algae <input type="checkbox"/> Other:	
Pipe benthic growth	<input type="checkbox"/>	<input type="checkbox"/> Brown <input type="checkbox"/> Orange <input type="checkbox"/> Green <input type="checkbox"/> Other:	

Figure 37: Section 5 of the ORI Field Sheet

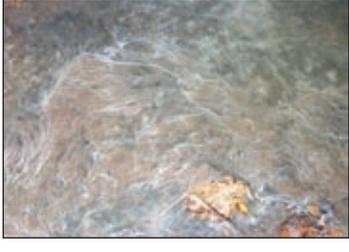
		
<p>Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.</p>	<p>This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.</p>	<p>Sporalitis filamentous bacteria, also known as “sewage fungus” can be used to track down sanitary sewer leaks.</p>
		
<p>Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.</p>	<p>Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.</p>	<p>The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.</p>
		
<p>This brownish algae indicates an elevated nutrient level.</p>		

Figure 38: Interpreting Benthic and Other Biotic Indicators

 <p>Reddish staining on the rocks below this outfall indicate high iron concentrations.</p>	 <p>Toilet paper directly below the storm drain outlet.</p>	 <p>Watershed Protection??</p>
 <p>Trash is not an indicator of illicit discharges, but should be noted.</p>	 <p>Staining at the base of the outfall may indicate a persistent, intermittent discharge.</p>	 <p>Excessive vegetation may indicate enriched flows associated with sewage.</p>
 <p>Brownish stain of unclear origin. May be from degradation of the brick infrastructure.</p>	 <p>Cracked rock below the outfall may indicate an intermittent discharge.</p>	 <p>Poor pool quality. Consider sampling from the pool to determine origin.</p>

Figure 39: Typical Findings at Both Flowing and Non-Flowing Outfalls

11.9 ORI Sections 6-8 - Initial Outfall Designation and Actions

The last three sections of the ORI field sheet are where the crew designates the illicit discharge severity of the outfall and recommends appropriate management and monitoring actions (Figure 40). A discharge rating is designated as obvious, suspect,

potential or unlikely, depending on the number and severity of discharge indicators checked in preceding sections.

It is important to understand that the ORI designation is only an initial determination of discharge potential. A more certain determination as to whether it actually is an illicit discharge is made using a more sophisticated indicator monitoring method. Nevertheless, the ORI outfall

designation gives program managers a better understanding of the distribution and severity of illicit discharge problems within a subwatershed.

Section 7 of the ORI field sheet records whether indicator samples were collected for laboratory analysis, or whether an intermittent flow trap was installed (e.g., an optical brightener trap or caulk dam described in Chapter 13). Field crews should record whether the sample was taken from a pool or directly from the outfall, and the type of intermittent flow trap used, if any. This section can also be used to recommend follow-up sampling, if the crew does not carry sample bottles or traps during the survey.

The last section of the ORI field sheet is used to note any unusual conditions near the outfall such as dumping, pipe failure, bank erosion or maintenance needs. While these maintenance conditions are not directly related to illicit discharge detection, they often are of interest to other agencies and utilities that maintain infrastructure.

11.10 Customizing the ORI for a Community

The ORI method is meant to be adaptable, and should be modified to reflect local conditions and field experience. Some

indicators can be dropped, added or modified in the ORI form. This section looks at four of the most common adaptations to the ORI:

- Open Channels
- Submerged/Tidally Influenced Outfalls
- Cold Climates
- Use of Biological Indicators

In each case, it may be desirable to revise the ORI field sheet to collect data reflecting these conditions.

Open Channels

Field crews face special challenges in more rural communities that have extensive open channel drainage. The ditches and channels serve as the primary storm water conveyance system, and may lack storm drain and sewer pipes. The open channel network is often very long with only a few obvious outfalls that are located far apart. While the network can have illicit discharges from septic systems, they can typically only be detected in the ORI if a straight pipe is found. Some adaptations for open channel systems are suggested in Table 33.

Section 6: Overall Outfall Characterization

Unlikely Potential (presence of two or more indicators) Suspect (one or more indicators with a severity of 3) Obvious

Section 7: Data Collection

1. Sample for the lab?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. If yes, collected from:	<input type="checkbox"/> Flow	<input type="checkbox"/> Pool
3. Intermittent flow trap set?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	If Yes, type: <input type="checkbox"/> OBM <input type="checkbox"/> Caulk dam	

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Figure 40: Sections 6-8 of the ORI Field Sheet

Submerged/Tidally Influenced Outfalls

The ORI can be problematic in coastal communities where outfalls are located along the waterfront and may be submerged at high tide. The ORI methods need to be significantly changed to address these constraints. Often, outfalls are initially located from offshore using canoes or boats, and then traced landward to the first manhole that is not tidally influenced. Field crews then access the storm drain pipe at the manhole and measure whatever indicators they can observe in the confined and dimly lit space. Table 33 recommends strategies to sample outfalls in the challenging environment of coastal communities.

Winter and Ice

Ice can be used as a discharge indicator in northern regions when ice forms in streams and pipes during the winter months (Figure 41). Because ice lasts for many weeks, and most illicit discharges are warm, astute field crews can interpret outfall history from ice melting patterns along pipes and streams. For example, exaggerated

melting at a frozen or flowing outfall may indicate warm water from sewage or industrial discharge. Be careful, because groundwater is warm enough to cause some melting at below freezing temperatures. Also, ice acts like an intermittent flow trap, and literally freezes these discharges. Crews should also look for these traps to find any discolored ice within the pipe or below the outfall.

A final winter indicator is “rime ice,” which forms when steam freezes. This beautiful ice formation is actually a good indicator of sewage or other relatively hot discharge that causes steam to form (Figure 41).

Biological Indicators

The diversity and pollution tolerance of various species of aquatic life are widely used as an indicator of overall stream health, and has sometimes been used to detect illicit discharges. One notable example is the presence of the red-eared slider turtle, which is used in Galveston, Texas to find sewage discharges, as they have a propensity for the nutrient rich waters associated with sewage (Figure 42).

Table 33: Special Considerations for Open Channels/Submerged Outfalls

OPEN CHANNELS	
Challenge	Suggested Modification
Too many miles of channel to walk	Stop walking at a given channel size or drainage area
Difficulty marking them	Mark on concrete or adjacent to earth channel
Interpreting physical indicators	For open channels with mild physical indicators, progress up the system to investigate further.
SUBMERGED/TIDALLY INFLUENCED OUTFALLS	
Challenge	Suggested Modification
Access for ORI – Tidal Influence	Access during low tide
Access for ORI – Always submerged	Access by boat or by shore walking
Interpreting physical indicators	For outfalls with mild physical indicators, also inspect from the nearest manhole that is not influenced by tides
Sampling (if necessary)	Sample “up pipe”



Figure 41: Cold climate indicators of illicit discharges



Figure 42: One biological indicator is this red-eared slider turtle

11.11 Interpreting ORI Data

The ORI generates a wealth of information that can provide managers with valuable insights about their illicit discharge problems, if the data are managed and analyzed effectively. The ORI can quickly define whether problems are clustered in a particular area or spread across the community. This section presents a series of methods to compile, organize and interpret ORI data, including:

1. Basic Data Management and Quality Control
2. Outfall Classification
3. Simple Suspect Outfall Counts
4. Mapping ORI Data
5. Subwatershed and Reach Screening
6. Characterizing IDDE Problems at the Community Level

The level of detail for each analysis method should be calibrated to local resources, program goals, and the actual discharge problems discovered in the stream corridor. In general, the most common conditions and problems will shape your initial monitoring strategy, which prioritizes the subwatersheds or reaches that will be targeted for more intensive investigations.

Program managers should analyze ORI data well before every stream mile is walked in the community, and use initial results to modify field methods. For example, if initial results reveal widespread potential problems, program managers may want to add more indicator monitoring to the ORI to track down individual discharge sources (see Chapter 12). Alternatively, if the same kind of discharge problem is repeatedly found, it may be wise to investigate whether there is a common source or activity generating it (e.g., high turbidity observed at many flowing outfalls as a result of equipment washing at active construction sites).

Basic Data Management and Quality Control

The ORI produces an enormous amount of raw data to characterize outfall conditions. It is not uncommon to compile dozens of individual ORI forms in a single subwatershed. The challenge is to devise a system to organize, process, and translate this data into simpler outputs and formats that can guide illicit discharge elimination efforts. The system starts with effective quality control procedures in the field.

Field sheets should be managed using either a three-ring binder or a clipboard. A small field binder offers the ability to quickly flip back and forth among the outfall forms. Authorization letters, emergency contact lists, and extra forms can also be tucked inside.

At the end of each day, field crews should regroup at a predetermined location to compare notes. The crew leader should confirm that all survey reaches and outfalls of interest have been surveyed, discuss initial findings, and deal with any logistical problems. This is also a good time to check whether field crews are measuring and recording outfall data in the same way, and are consistent in what they are (or are not) recording. Crew leaders should also use this time to review field forms for accuracy and thoroughness. Illegible handwriting should be neaten and details added to notes and any sketches. The crew leader should also organize the forms together into a single master binder or folder for future analysis.

Once crews return from the field, data should be entered into a spreadsheet or database. A Microsoft Access database is provided with this Manual as part of Appendix D (Figure 43), and is supplied

on a compact disc with each hard copy. It can also be downloaded with Appendix D from <http://www.stormwatercenter.net>. Information stored in this database can easily be imported into a GIS for mapping purposes. The GIS can generate its own database table that allows the user to create subwatershed maps showing outfall characteristics and problem areas.

Once data entry is complete, be sure to check the quality of the data. This can be done quickly by randomly spot-checking 10% of the entered data. For example, if 50 field sheets were completed, check five of the spreadsheet or database entries. When transferring data into GIS, quality control maps that display labeled problem outfalls should be created. Each survey crew is responsible for reviewing the accuracy of these maps.

Outfall Classification

A simple outfall designation system has been developed to summarize the discharge potential for individual ORI field sheets. Table 34 presents the four outfall designations that can be made.

Designation	Description
1. Obvious Discharge	Outfalls where there is an illicit discharge that doesn't even require sample collection for confirmation
2. Suspect Discharge	Flowing outfalls with high severity on one or more physical indicators
3. Potential Discharge	Flowing or non-flowing outfalls with presence of two or more physical indicators
4. Unlikely Discharge	Non-flowing outfalls with no physical indicators of an illicit discharge

Simple Suspect Outfall Counts

The first priority is to count the frequency of each outfall designation in the subwatershed or the community as a whole. This simple screening analysis counts the number of problem outfalls per stream mile (i.e., the sum of outfalls designated as having potential, suspected or obvious illicit discharge potential). The density of problem outfalls per stream mile is an important metric to target and screen subwatersheds.

Based on problem outfall counts, program managers may discover that a particular monitoring strategy may not apply to the community. For example, if few problem outfalls are found, an extensive follow-up monitoring program may not be needed, so that program resources can be shifted to pollution hotlines to report and control transitory discharges such as illegal dumping. The key point of this method is to avoid getting lost in the raw data, but look instead to find patterns that can shape a cost-effective IDDE program.

Mapping ORI Data

Maps are an excellent way to portray outfall data. If a GIS system is linked to the ORI database, maps that show the spatial distribution of problem outfalls, locations of dumping, and overall reach conditions can be easily generated. Moreover, GIS provides flexibility that allows for rapid updates to maps as new data are collected and compiled. The sophistication and detail of maps will depend on the initial findings, program goals, available software, and GIS capability.

Subwatershed maps are also an effective and important communication and education tool to engage stakeholders (e.g., public officials, businesses and community residents), as

they can visually depict reach quality and the location of problem outfalls. The key point to remember is that maps are tools for understanding data. Try to map with a purpose in mind. A large number of cluttered maps may only confuse, while a smaller number with select data may stimulate ideas for the follow-up monitoring strategy.

Subwatershed and Survey Reach Screening

Problem outfall metrics are particularly valuable to screen or rank priority subwatersheds or survey reaches. The basic approach is simple: select the outfall metrics that are most important to IDDE program goals, and then see how individual subwatersheds or reaches rank in the process. This screening process can help determine which subwatersheds will be priorities for initial follow-up monitoring efforts. When feasible, the screening process should incorporate non-ORI data, such as existing dry weather water quality data, citizen complaints, permitted facilities, and habitat or biological stream indicators.

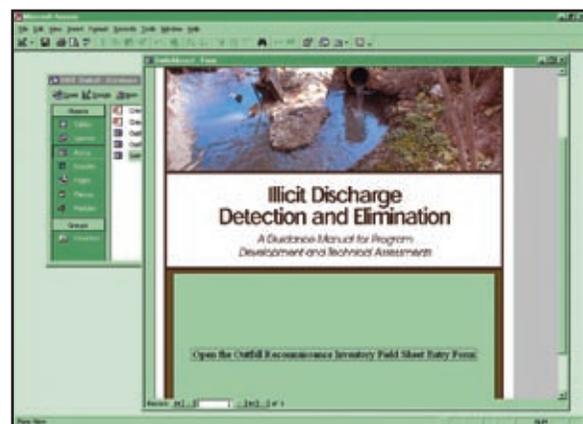


Figure 43: Sample screen from ORI Microsoft Access database

An example of how outfall metrics can screen subwatersheds is provided in Table 35. In this hypothetical example, four metrics were used to screen three subwatersheds within a community: number of suspect discharges, subwatershed population as a percent of the total community, number of industrial discharge permits, and number of outfalls per stream mile. Given these screening criteria, subwatershed C was selected for the next phase of detailed investigation.

Characterizing the IDDE Problem at the Community Level

ORI data should be used to continuously revisit and revise the IDDE program as more is learned about the nature and

distribution of illicit discharge problems in the community. For example, ORI discharge designation should be compared against illicit discharge potential (IDP) predictions made during the original desktop analysis (Chapter 5) to refine discharge screening factors, and formulate new monitoring strategies.

In general, community illicit discharge problem can be characterized as minimal, clustered, or severe (Table 36). In the minimal scenario, very few and scattered problems exist; in the clustered scenario, problems are located in isolated subwatersheds; and in the severe scenario, problems are widespread.

Table 35: An Example of ORI Data Being Used to Compare Across Subwatersheds

	# of suspect discharges	Population as % of total community	# of industrial discharge permits	# of outfalls per stream/conveyance mile
Subwatershed A	2	30	4	6
Subwatershed B	1	10	0	3
Subwatershed C	8	60	2	12

Table 36: Using Stream and ORI Data to Categorize IDDE Problems

Extent	ORI Support Data
Minimal	<ul style="list-style-type: none"> • Less than 10% of total outfalls are flowing • Less than 20% of total outfalls with obvious, suspect or potential designation
Clustered	<ul style="list-style-type: none"> • Two thirds of the flowing outfalls are located within one third of the subwatersheds • More than 20% of the communities subwatersheds have greater than 20% of outfalls with obvious, suspect or potential designation
Severe	<ul style="list-style-type: none"> • More than 10% of total outfalls are flowing • More than 50% of total outfalls with obvious, suspect or potential designation • More than 20% of total outfalls with obvious or suspect designation

11.12 Budgeting and Scoping the ORI

Many different factors come into play when budgeting and scoping an ORI survey: equipment needs, crew size and the stream miles that must be covered. This section presents some simple rules of thumb for ORI budgeting.

Equipment costs for the ORI are relatively minor, with basic equipment to outfit one team of three people totaling about \$800 (Table 37). This cost includes one-time expenses to acquire waders, a digital camera and a GPS unit, as well as disposable supplies.

The majority of the budget for an ORI is for staffing the desktop analysis, field crews and data analysis. Field crews can consist of two or three members, and cover about two to three miles of stream (or open channel) per day. Three staff-days should be allocated for pre- and post-field work for each day spent in the field.

Table 38 presents example costs for two hypothetical communities that conduct the ORI. Community A has 10 miles of open channel to investigate, while Community B has 20 miles. In addition, Community A has fewer staff resources available and therefore uses two-person field crews, while Community B uses three-person field crews. Total costs are presented as annual costs, assuming that each community is able to conduct the ORI for all miles in one year.

Item	Cost
100 Latex Disposable Gloves	\$25
5 Wide Mouth Sample Bottles (1 Liter)	\$20
Large Cooler	\$25
3 Pairs of Waders	\$150
Digital Camera	\$200
20 Cans of Spray Paint	\$50
Test Kits or Probes	\$100-\$500
1 GPS Unit	\$150
1 Measuring Tape	\$10
1 First Aid Kit	\$30
Flashlights, Batteries, Labeling tape, Clipboards	\$25
Total	\$785-\$1185

Table 38: Example ORI Costs		
Item	Community A	Community B
Field Equipment ¹	\$700	\$785
Staff Field Time ²	\$2,000	\$6,000
Staff Office Time ³	\$3,000	\$6,000
Total	\$5,700	\$12,785
¹ From Table 44 ² Assumes \$25/hour salary (2 person teams in Community A and three- person teams in Community B) and two miles of stream per day. ³ Assumes three staff days for each day in field.		

Chapter 12: Indicator Monitoring

Indicator monitoring is used to confirm illicit discharges, and provide clues about their source or origin. In addition, indicator monitoring can measure improvements in water quality during dry weather flow as a result of the local IDDE program. This chapter reviews the suite of chemical indicator parameters that can identify illicit discharges, and provides guidance on how to collect, analyze and interpret each parameter.

Program managers have a wide range of indicator parameters and analytical methods to choose from when determining the presence and source of illicit discharges. The exact combination of indicator parameters and methods selected for a community is often unique. This chapter recommends some general approaches for communities that are just starting an indicator monitoring program or are looking for simple, cost-

effective, and safe alternatives to their current program.

Organization of the Chapter

This chapter provides technical support to implement the basic IDDE monitoring framework shown in Figure 44, and is organized into eight sections as follows:

1. Review of indicator parameters
2. Sample collection considerations
3. Methods to analyze samples
4. Methods to distinguish flow types
5. Chemical library
6. Special monitoring methods for intermittent and transitory discharges
7. In-stream dry weather monitoring
8. Costs for indicator monitoring

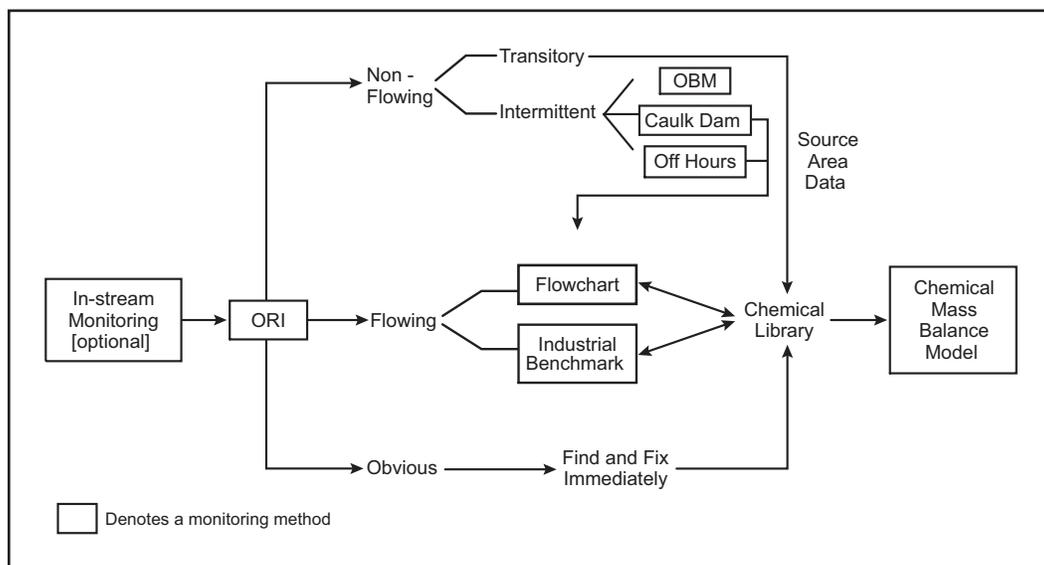


Figure 44: IDDE Monitoring Framework

Program managers developing an indicator monitoring program need a solid background in basic water chemistry, and field and laboratory methods. This chapter describes the major factors to consider when designing an indicator monitoring program for illicit discharges, and assumes some familiarity with water quality sampling and analysis protocols.

Indicator monitoring terminology can be confusing, so some of the basic terms are defined as they specifically relate to illicit discharge control. Some of the common terms introduced in this Chapter are defined below:

Chemical Library: A database and statistical summary of the chemical characteristics, or “fingerprint” of various discharge flow types in a community (e.g., sewage, wash water, shallow groundwater, tap water, irrigation water, and liquid wastes). The library is assembled by collecting and analyzing representative samples from the source of each major flow type in the community.

Chemical Mass Balance Model (CMBM): A computer model that uses flow characteristics from a chemical library file of flow types to estimate the most likely source components that contribute to dry weather flows.

Detergents: Commercial or retail products used to wash clothing. Presence of detergents in flow is usually measured as surfactants or fluorescence.

False Negative: An indicator sample that identifies a discharge as uncontaminated when it actually is contaminated.

False Positive: An indicator sample that identifies a discharge as contaminated when it is not.

Flow Chart Method: The use of four indicators (surfactants, ammonia, potassium, and fluoride) to identify illicit discharges.

Indicator Parameter: A water quality measurement that can be used to identify a specific discharge flow type, or discriminate between different flow types.

Monitoring: A strategy of sample collection and laboratory analysis to detect and characterize illicit discharges.

Optical Brightener Monitoring (OBM) Traps: Traps that use absorbent pads to capture dry weather flows, which can later be observed under a fluorescent light to determine if detergents using optical brighteners were present.

Reagent: A chemical added to a sample to create a reaction that enables the measurement of a target chemical parameter.

Sampling: Water sample collection from an outfall, pipe or stream, along with techniques to store and preserve them for subsequent laboratory analysis.

Surfactants: The main component of commercial detergents that detaches dirt from the clothing. The actual concentration of surfactants is much lower than the concentration of detergent, but analytical methods that measure surfactants are often referred to as “detergents.” To avoid confusion, this chapter expresses the concentration of surfactants as “detergents as surfactants.”

12.1 Indicator Parameters to Identify Illicit Discharges

At least fifteen different indicator parameters can confirm the presence or origin of an illicit discharge. These parameters are discussed in detail in Appendix F and include:

- Ammonia
- Boron
- Chlorine
- Color
- Conductivity
- Detergents
- *E. coli*, enterococi, and total coliform
- Fluorescence
- Fluoride
- Hardness
- pH
- Potassium
- Surface Tension
- Surfactants
- Turbidity

In most cases, however, only a small subset of indicator parameters (e.g., three to five) is required to adequately characterize an illicit discharge. This section summarizes the different indicator parameters that have been used.

An ideal indicator parameter should reliably distinguish illicit discharges from clean water and provide clues about its sources. In addition, they should have the following characteristics:

- Have a significantly different concentration for major flow or discharge types

- Exhibit relatively small variations in concentrations within the same flow or discharge type
- Be conservative (i.e., concentration will not change over time due to physical, chemical or biological processes)
- Be easily measured with acceptable detection limits, accuracy, safety and repeatability.

No single indicator parameter is perfect, and each community must choose the combination of indicators that works best for their local conditions and discharge types. Table 39 summarizes the parameters that meet most of the indicator criteria, compares their ability to detect different flow types, and reviews some of the challenges that may be encountered when measuring them. More details on indicator parameters are provided in Appendix F.

Data in Table 39 are based on research by Pitt (Appendix E) conducted in Alabama, and therefore, the percentages shown to distinguish “hits” for specific flow types should be viewed as representative and may shift for each community. Also, in some instances, indicator parameters were “downgraded” to account for regional variation or dilution effects. For example, both color and turbidity are excellent indicators of sewage based on discharge fingerprint data, but both can vary regionally depending on the composition of clean groundwater.

Table 39: Indicator Parameters Used to Detect Illicit Discharges

Parameter	Discharge Types It Can Detect				Laboratory/Analytical Challenges
	Sewage	Washwater	Tap Water	Industrial or Commercial Liquid Wastes	
Ammonia	●	⊙	○	⊙	Can change into other nitrogen forms as the flow travels to the outfall
Boron	⊙	⊙	○	N/A	
Chlorine	○	○	○	⊙	High chlorine demand in natural waters limits utility to flows with very high chlorine concentrations
Color	⊙	⊙	○	⊙	
Conductivity	⊙	⊙	○	⊙	Ineffective in saline waters
Detergents – Surfactants	●	●	○	⊙	Reagent is a hazardous waste
<i>E. coli</i> Enterococci Total Coliform	⊙	○	○	○	24-hour wait for results Need to modify standard monitoring protocols to measure high bacteria concentrations
Fluoride*	○	○	●	⊙	Reagent is a hazardous waste Exception for communities that do not fluoridate their tap water
Hardness	⊙	⊙	⊙	⊙	
pH	○	⊙	○	⊙	
Potassium	⊙	○	○	●	May need to use two separate analytical techniques, depending on the concentration
Turbidity	⊙	⊙	○	⊙	

● Can almost always (>80% of samples) distinguish this discharge from clean flow types (e.g., tap water or natural water). For tap water, can distinguish from natural water.
 ⊙ Can sometimes (>50% of samples) distinguish this discharge from clean flow types depending on regional characteristics, or can be helpful in combination with another parameter
 ○ Poor indicator. Cannot reliably detect illicit discharges, or cannot detect tap water
 N/A: Data are not available to assess the utility of this parameter for this purpose.
 Data sources: Pitt (this study)
 *Fluoride is a poor indicator when used as a single parameter, but when combined with additional parameters (such as detergents, ammonia and potassium), it can almost always distinguish between sewage and washwater.

12.2 Sample Collection Considerations

Sample collection is an important aspect of an IDDE program. Program managers need to be well informed about the key facets of sampling such as sample handling, QA/QC, and safety. The guidance in this section is limited to an overview of sample collection considerations including: equipment needed

for collecting samples, elements of sampling protocols, and general tips. Several useful documents are available that detail accepted water quality sampling protocols such as the following:

- Burton and Pitt (2002) - Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers

- USGS National Field Manual for the Collection of Water-Quality Data
<http://water.usgs.gov/owq/FieldManual/>
- *Standard Methods for the Examination of Water and Wastewater*
<http://www.standardmethods.org/>
- *EPA NPDES Stormwater Sampling Guidance Document*
<http://cfpub.epa.gov/npdes> (Note: while this document is oriented towards wet weather sampling, there are still many sampling procedures that apply to dry weather sampling)

State environmental agencies are also a good resource to contact for recommended or required sampling protocols.

Equipment Needed for Field Sampling

The basic equipment needed to collect samples is presented in Table 40. Most sampling equipment is easily available for purchase from scientific supply companies and various retail stores.

Developing a Consistent Sample Collection Protocol

Samples should never be collected haphazardly. To get reliable, accurate, and defensible data, it is important to develop a consistent field sampling protocol to collect each indicator sample. A good field sampling protocol incorporates eight basic elements:

1. Where to collect samples
2. When to collect samples
3. Sample bottle preparation
4. Sample collection technique
5. Storage and preservation of samples
6. Sample labeling and chain of custody plan

7. Quality assurance/control samples
8. Safety considerations

Appendix G provides more detail on each monitoring element. Some communities already have established sampling protocols that are used for in-stream or wet weather sampling. In most cases these existing sampling protocols are sufficient to conduct illicit discharge sampling.

Tips for Collecting Illicit Discharge Samples

The following tips can improve the quality of your indicator monitoring program.

1. Remember to fill out an ORI field form at every outfall where samples are collected. The ORI form documents sample conditions, outfall characteristics and greatly aids in interpreting indicator monitoring data.
2. Most state water quality agencies have detailed guidance on sampling protocols. These resources should be consulted and the appropriate guidelines followed. Another useful guidance on developing a quality assurance plan is the “Volunteer Monitor’s Guide to Quality Assurance Project Plans” (EPA, 1996).

Table 40: Equipment Needed for Sample Collection

- A cooler (to be kept in the vehicle)
- Ice or “blue ice” (to be kept in the vehicle)
- Permanent marker (for labeling the samples)
- Labeling tape or pre-printed labels
- Several dozen one-liter polyethylene plastic sample bottles
- A “dipper,” a measuring cup at the end of a long pole, to collect samples from outfalls that are hard to reach
- Bacteria analysis sample bottles (if applicable), typically pre-cleaned 120mL sample bottles, to ensure against contamination

3. Sample in batches where feasible to cut down on field and mobilization time.
4. Avoid sampling lagged storm water flows by sampling at least 48 to 72 hours after runoff producing events.
5. It may be necessary to collect multiple samples at a single outfall if preservatives are going to be used. Preservatives are typically necessary when long hold times are required for samples before analysis occurs. Appendix G contains guidance on the required preservation and maximum allowable hold times for various parameters.

12.3 Methods to Analyze Indicator Samples

This section reviews methods to analyze indicator samples, and begins with a discussion of whether they should be analyzed in-house or sent to an independent contract lab. Next, recommended methods for analyzing indicator parameters are outlined, along with data on their comparative cost, safety, and accuracy. Lastly, tips are offered to improve an indicator monitoring program.

Analyzing Samples In-house vs. Contract Lab

Program managers need to decide whether to analyze samples in-house, or through an independent monitoring laboratory. The decision on which route to take is often based on the answers to the following questions:

- *What level of precision or accuracy is needed for the indicator parameter(s)?*
Precise and accurate data are needed when indicator monitoring is used to legally document a violation or

enforcement action. The lab setting is important, since the quality of the data may be challenged. Precise data are also needed for outfalls that have very large drainage areas. These discharges are often diluted by groundwater, so lab methods must be sensitive and have low detection limits to isolate illicit discharges that are masked or blended with other flow types. Accurate data are also needed for large outfalls since the cost and effort triggered by a false positive reading to track and isolate discharges in a large and complex drainage area is much greater.

- *How quickly are sampling results needed?* Fast results are essential if the community wants to respond instantly to problem outfalls. In this case, the capability to collect and analyze indicator samples in-house is desirable to provide quick response.
- *How much staff time and training is needed to support in-house analysis?* Local staff that perform lab analysis must be certified in laboratory safety, quality control and proper analytical procedures. Communities that do not expect to collect many indicator samples may want to utilize a contract lab to reduce staff training costs.
- *Does a safe environment exist to analyze samples and dispose of wastes?* A safe environment is needed for lab analysis including storage in a fireproof environment, eyewash stations, safety showers, fume hoods and ventilation. Lab workers should have standard safety equipment such as gloves, safety glasses and lab coats. Lastly, many of the recommended analytical methods create small quantities of hazardous wastes that need to be properly disposed. Program

managers should carefully evaluate in-house work space to determine if a safe lab environment can be created.

- *What is the comparative cost for sample analysis in each option?* The initial up-front costs to use an independent laboratory are normally lower than those required to establish an in-house analysis capability. An in-house analysis capability normally becomes cost-effective when a community expects to analyze more than 100 indicator samples per year. Section 12.8 outlines some of the key budget factors to consider when making this decision, but program managers should always get bids from reputable and certified contract labs to determine analysis costs.
- *Are existing monitoring laboratories available in the community?* Cost savings are often realized if an existing wastewater treatment or drinking water lab can handle the sample analysis. These labs normally possess the equipment, instruments and trained staff to perform the water quality analyses for indicator parameters.

Considerations for In-house Analysis Capability

Three basic settings can be used to analyze indicator parameters in-house: direct field measurements, small office lab, and a more formal municipal lab. The choice of which in-house setting to use depends on the indicator parameters selected, the need for fast and accurate results and safety/disposal considerations.

In-Field Analysis – A few indicator parameters can be analyzed in the field with probes and other test equipment (Figure 45). While most field parameters can identify

problem outfalls, they generally cannot distinguish the specific type of discharge. Some of the situations where in-field analysis¹⁰ is best applied are:

- When a community elects to use one or two indicator parameters, such as ammonia and potassium, that can be measured fairly easily in the field
- When field crews measure indicator parameters to trace or isolate a discharge in a large storm drain pipe network, and need quick results to decide where to go next

Office Analysis – Many of the recommended indicator parameters can be analyzed in an informal “office” lab with the possible exception of surfactants and fluoride (Figure 46). The office analysis option makes sense in communities that have available and trained staff, and choose analytical methods that are safe and have few hazardous waste disposal issues. Another option is to use the office lab to conduct most indicator analyses, but send out fluoride and surfactant indicator samples to a contract lab.

TIP

The methodology for any bacteria analysis also has a waste disposal issue (e.g., biohazard). Check state guidance for appropriate disposal procedures.

¹⁰ Some communities have had success with in-field analysis; however, it can be a challenging environment to conduct rapid and controlled chemical analysis. Therefore, it is generally recommended that the majority of analyses be conducted in a more controlled “lab” setting.

Formal Laboratory Setting – The ideal option in many communities is to use an existing municipal or university laboratory. Existing labs normally have systems in place to dispose of hazardous material, have room and facilities for storing samples, and are equipped with worker safety features. Be careful to craft a schedule that does not interfere with other lab activities.

When in-house analysis is used, program managers need to understand the basic analytical options, safety considerations, equipment needs and analysis costs for each analytical method used to measure indicator parameters. This understanding helps program managers choose what indicator parameters to collect and where they should be analyzed. Much of this information is

detailed in Appendix F and summarized below.

Supplies and Equipment

The basic supplies needed to perform lab analysis are described in Table 41, and are available from several scientific equipment suppliers. In addition, reagents, disposable supplies and some specialized instruments may be needed, depending on the specific indicator parameters analyzed. For a partial list of suppliers, consult the Volunteer Stream Monitoring Manual (US EPA, 1997), which can be accessed at www.epa.gov/owow/monitoring/volunteer/stream/appendb.html. Table 42 summarizes the equipment needed for each analytical method.



Figure 45: Analyzing samples in the back of a truck



Figure 46: Office/lab set up in Fort Worth, TX

Table 41: Basic Lab Supplies	
<p>Disposable Supplies</p> <ul style="list-style-type: none"> • Deionized water (start with about 10 gallons, unless a reverse osmosis machine is available) • Nitric acid for acid wash (one or two gallons to start) <p style="text-align: center;">Safety</p> <ul style="list-style-type: none"> • Lab or surgical gloves • Lab coats • Safety glasses 	<p>Glassware/Tools</p> <ul style="list-style-type: none"> • About two dozen each of 100 and 200 mL beakers • Two or three 100 mL graduated cylinders • Two or three tweezers • Pipettes to transfer samples in small quantities

Table 42: Analytical Methods Supplies Needed				
Indicator Parameter	Specific Glassware	Equipment	Reagents or Kits	Unique Suppliers
Ammonia	Sample Cells	Spectrophotometer or Colorimeter	Hach reagents for method 8155	www.hach.com
Boron	None	Spectrophotometer or Colorimeter	Hach reagents for method 10061	www.hach.com
Chlorine	None	Spectrophotometer or Colorimeter	Hach reagents for method 8021	www.hach.com
Color	None	None	Color Kit	www.hach.com
Conductivity	None	Horiba probe	Standards	www.horiba.com
Detergents - Surfactants (MBAS)	None	None	Chemets Detergents Test	www.chemetrics.com
<i>E. Coli</i>	None	Sealer Black Light Comparator	Colilert Reagent Quanti-Tray Sheets	IDEXX Corporation www.idexx.com
Fluorescence	Cuvettes	Fluorometer	None	Several
Fluoride	None	Spectrophotometer or Colorimeter	Hach reagents for method 8029	www.hach.com
Hardness	Erlenmeyer Flask	Burette and Stand or Digital Titrator	EDTA Cartridges or Reagent and Buffer Solution	www.hach.com
pH	None	Horiba Probe	Standards	www.horiba.com
Potassium	None	Horiba Probe	Standards	www.horiba.com
Potassium (Colorimetric)	None	Spectrophotometer or Colorimeter	Hach Reagents for method 8012	www.hach.com

Cost

Table 43 compares the per sample cost to analyze indicator parameters. In general, the per sample cost is fairly similar for most parameters, with the exception of bacteria analyses for *E. coli*, total coliform, or Enterococci. Reagents typically cost

less than \$2.00 per sample, and equipment purchases seldom exceed \$1,000. The typical analysis time averages less than 10 minutes per sample. More information on budgeting indicator monitoring programs can be found in Section 12.8.

Table 43: Chemical Analysis Costs

Parameter	Analysis Cost				
	Per Sample Costs				Approximate Initial Equipment Cost (Item)
	Disposable Supplies	Analysis Time (min/sample)	Staff Cost (@\$25/hr)	Total Cost Per Sample	
Ammonia	\$1.81	25 ³	\$10.42	\$12.23	\$950 ⁴ (Colorimeter)
Boron	\$0.50	20 ³	\$8.33	\$8.83	\$950 ⁴ (Colorimeter)
Chlorine	\$0.60	5	\$2.08	\$2.68	\$950 ⁴ (Colorimeter)
Color	\$0.52	1	\$0.42	\$0.94	\$0
Conductivity	\$0.65 ²	4 ³	\$1.67	\$2.32	\$275 (Probe)
Detergents – Surfactants ¹	\$3.15	7	\$2.92	\$6.07	\$0
Enterococci, <i>E. Coli</i> or Total Coliform ¹	\$6.75	7 (24 hour waiting time)	\$2.92	\$9.67	\$4,000 (Sealer and Incubator)
Fluoride ¹	\$0.68	3	\$1.25	\$1.93	\$950 ⁴ (Colorimeter)
Hardness	\$1.72	5	\$2.08	\$3.80	\$125 (Digital Titrator)
pH	\$0.65 ²	3.5 ³	\$1.46	\$2.11	\$250 (Probe)
Potassium (High Range)	\$0.50 ²	5.5 ³	\$2.29	\$2.79	\$250 (Probe)
Potassium (Low Range)	\$1.00	5	\$2.08	\$3.08	\$950 ⁴ (Colorimeter)
Turbidity	\$0.50 ²	6 ³	\$2.50	\$3.00	\$850 (Turbidimeter)

¹ Potentially high waste disposal cost for these parameters.
² The disposable supplies estimates are based on the use of standards to calibrate a probe or meter.
³ Analysts can achieve significant economies of scale by analyzing these parameters in batches.
⁴ Represents the cost of a colorimeter. The price of a spectrophotometer, which measures a wider range of parameters, is more than \$2,500. This one-time cost can be shared among chlorine, fluoride, boron, potassium and ammonia.

Additional Tips for In-house Laboratory Analysis

The following tips can help program managers with in-house laboratory analysis decisions:

- Program managers may want to use both in-house analysis and contract labs

to measure the full range of indicator parameters needed in a safe and cost-effective manner. In this case, a split sample analysis strategy is used, where some samples are sent to the contract lab, while others are analyzed in house.

- Remember to order enough basic lab supplies, because they are relatively cheap and having to constantly re-order supplies and wash glassware can be time-consuming. In addition, some scientific supply companies have minimum order amounts, below which additional shipping and handling is charged.
 - Be careful to craft a sample analysis schedule that doesn't interfere with other lab operations, particularly if it is a municipal lab. With appropriate preservation, many samples can be stored for several weeks.
4. Ensure that the maximum hold time for each indicator parameter exceeds the time it takes to ship samples to the lab for analysis.
 5. Carefully review and understand the shipping and preservation instructions provided by the contract lab.
 6. Look for labs that offer electronic reporting of sample results, which can greatly increase turn-around time, make data analysis easier, and improve response times.
 7. Periodically check the lab's QA/QC procedures, which should include lab spikes, lab blanks, and split samples. The procedures for cleaning equipment and calibrating instruments should also be evaluated. These QA/QC procedures are described below.

Considerations for Choosing a Contract Lab

When a community elects to send samples to an independent contract lab for analysis, it should investigate seven key factors:

1. Make sure that the lab is EPA-certified for the indicator parameters you choose. A state-by-state list of EPA certified labs for drinking water can be found at: <http://www.epa.gov/safewater/privatewells/labs.html>. State environmental agencies are also good resources to contact for pre-approved laboratories.
 2. Choose a lab with a short turn-around time. Some Phase I communities had problems administering their programs because of long turn-around times from local labs (CWP, 2002). As a rule, a lab should be able to produce results within 48 hours.
 3. Clearly specify the indicator parameter and analysis method you want, using the guidance in this manual or advice from a water quality expert.
- *Lab spikes* – Samples of known concentration are prepared in the laboratory to determine the accuracy of instrument readings.
 - *Lab blanks* – Deionized water samples that have a known zero concentration are used to test methods, or in some methods to “zero” the instruments.
 - *Split samples* – Samples are divided into two separate samples at the laboratory for a comparative analysis. Any difference between the two sample results suggests the analysis method may not be repeatable.
 - *Equipment cleaning and instrument maintenance protocols* – Each lab should have specific and routine procedures to maintain equipment and clean glassware and tubing. These procedures should be clearly labeled on each piece of equipment.

- *Instrument calibration* – Depending on the method, instruments may come with a standard calibration curve, or may require calibration at each use. Lab analysts should periodically test the default calibration curve.

Table 44 summarizes estimated costs associated with sample analyses at a contract lab.

12.4 Techniques to Interpret Indicator Data

Program managers need to decide on the best combination of indicator parameters that will be used to confirm discharges and identify flow types. This section presents guidance on four techniques to interpret indicator parameter data:

- Flow Chart Method (recommended)
- Single Parameter Screening
- Industrial Flow Benchmarks
- Chemical Mass Balance Model (CMBM)

Parameter	Costs
Ammonia	\$12 - \$25
Boron	\$16 - \$20
Chlorine	\$6 - \$10
Color	\$7 - \$11
Conductivity	\$2 - \$6
Detergents – Surfactants	\$17- \$35
Enterococci, <i>E. Coli</i> or Total Coliform	\$17 - \$35
Fluoride	\$14 - \$25
Hardness	\$8 - \$16
pH	\$2 - \$7
Potassium	\$12 - \$14
Turbidity	\$9 - \$12

All four techniques rely on benchmark concentrations for indicator parameters in order to distinguish among different flow types. Program managers are encouraged to adapt each technique based on local discharge concentration data, and some simple statistical methods for doing so are provided throughout the section.

The Flow Chart Method

The Flow Chart Method is recommended for most Phase II communities, and was originally developed by Pitt *et al.* (1993) and Lalor (1994) and subsequently updated based on new research by Pitt during this project. The Flow Chart Method can distinguish four major discharge types found in residential watersheds, including sewage and wash water flows that are normally the most common illicit discharges. Much of the data supporting the method were collected in Alabama and other regions, and some local adjustment may be needed in some communities. The Flow Chart Method is recommended because it is a relatively simple technique that analyzes four or five indicator parameters that are safe, reliable and inexpensive to measure. The basic decision points involved in the Flow Chart Method are shown in Figure 47 and described below:

Step 1: Separate clean flows from contaminated flows using detergents

The first step evaluates whether the discharge is derived from sewage or washwater sources, based on the presence of detergents. Boron and/or surfactants are used as the primary detergent indicator, and values of boron or surfactants that exceed 0.35 mg/L and 0.25 mg/L, respectively, signal that the discharge is contaminated by sewage or washwater.

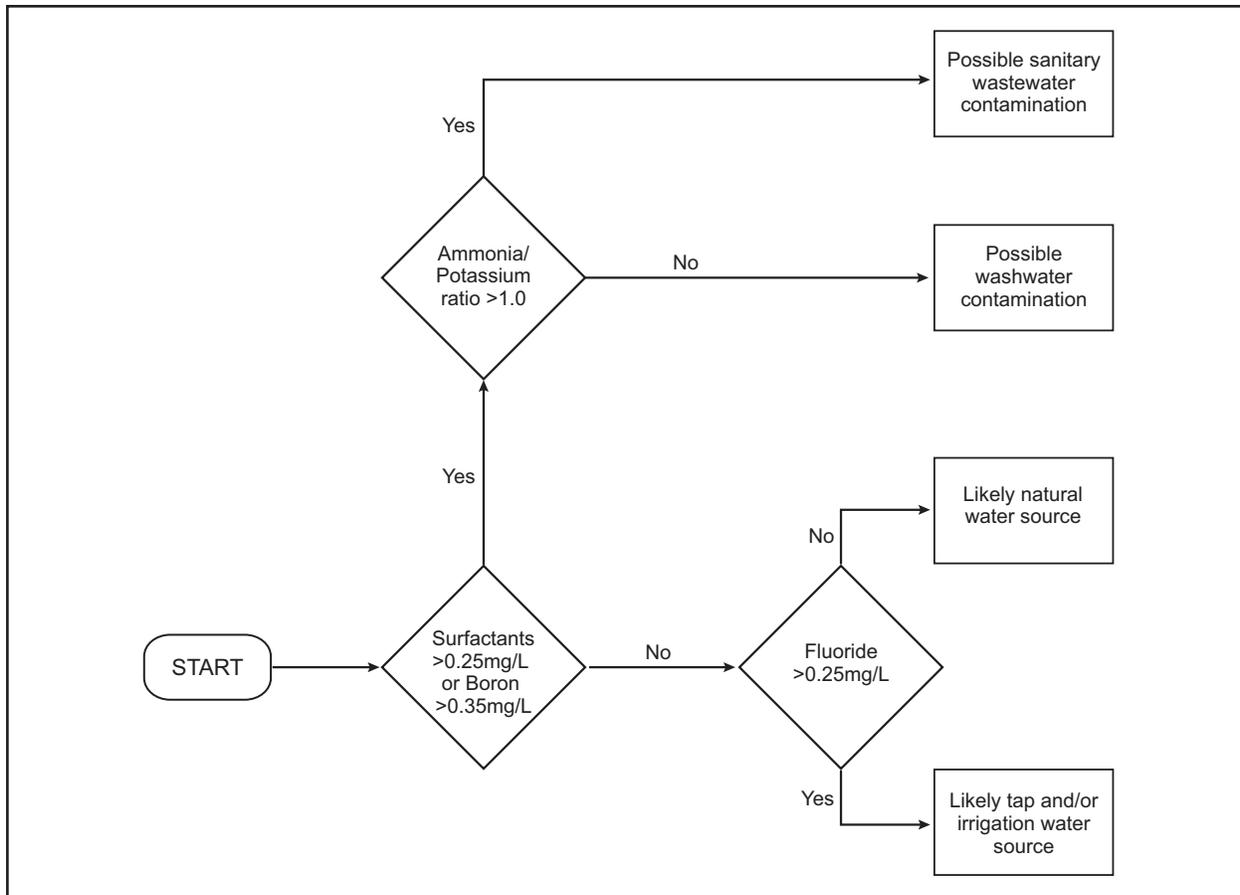


Figure 47: Flow Chart to Identify Illicit Discharges in Residential Watersheds

Step 2: Separate washwater from wastewater using the Ammonia/Potassium ratio

If the discharge contains detergents, the next step is to determine whether they are derived from sewage or washwater, using the ammonia to potassium ratios. A ratio greater than one suggests sewage contamination, whereas ratios less than one indicate washwater contamination. The benchmark ratio was developed by Pitt *et al.* (1993) and Lalor (1994) based on testing in urban Alabama watersheds.

Step 3: Separate tap water from natural water

If the sample is free of detergents, the next step is to determine if the flow is derived from spring/groundwater or comes from tap water. The benchmark indicator used in this step is fluoride, with concentrations exceeding 0.60 mg/L indicating that potable water is the source. Fluoride levels between 0.13 and 0.6 may indicate non-target irrigation water. The purpose of determining the source of a relatively “clean discharge” is that it can point to water line breaks, outdoor washing, non-target irrigation and other uses of municipal water that generate flows with pollutants.

Adapting the Flow Chart Method

The Flow Chart Method is a robust tool for identifying illicit discharge types, but may need to be locally adapted, since much of the supporting data was collected in one region of the country. Program managers should look at four potential modifications to the flow chart in their community.

- 1) Is boron or surfactants a superior local indicator of detergents?

Surfactants are almost always a more reliable indicator of detergents, except for rare cases where groundwater has been contaminated by sewage. The disadvantage of surfactants is that the recommended analytical method uses a hazardous chemical as the reagent. Boron uses a safer analytical method. However, if boron is used as a detergent indicator, program managers should sample boron levels in groundwater and tap water, since they can vary regionally. Also, not all detergent formulations incorporate boron at high levels, so it may not always be a strong indicator.

- 2) Is the ammonia/potassium ratio of one the best benchmark to distinguish sewage from washwater?

The ammonia/potassium ratio is a good way to distinguish sewage from washwater, although the exact ratio appears to vary in different regions of the country. The benchmark value for the ratio was derived from extensive testing in one Alabama city. In fact, data collected in another Alabama city indicated an ammonia/potassium ratio of 0.6 distinguished sewage from wash water. Clearly, program managers should evaluate the ratio in their own community, although the proposed ratio of 1.0 should still capture the majority of sewage discharges. The ratio can be refined over

time using indicator monitoring at local outfalls, or through water quality sampling of sewage and washwater flow types for the chemical library.

- 3) Is fluoride a good indicator of tap water?

Usually. The two exceptions are communities that do not fluoridate their drinking water or have elevated fluoride concentrations in groundwater. In both cases, alternative indicator parameters such as hardness or chlorine may be preferable.

- 4) Can the flow chart be expanded?

The flow chart presented in Figure 47 is actually a simplified version of a more complex flow chart developed by Pitt for this project, which is presented in Appendix H. An expanded flow chart can provide more consistent and detailed identification of flow types, but obviously requires more analytical work and data analysis. Section 12.5 provides guidance on statistical techniques to customize the flow chart method based on your local discharge data.

Single Parameter Screening

Research by Lalor (1994) suggests that detergents is the best single parameter to detect the presence or absence of the most common illicit discharges (sewage and washwater). The recommended analytical method for detergents uses a hazardous reagent, so the analysis needs to be conducted in a controlled laboratory setting with proper safety equipment. This may limit the flexibility of a community if it is conducting analyses in the field or in a simple office lab.

Ammonia is another single parameter indicator that has been used by some communities with widespread or severe

sewage contamination. An ammonia concentration greater than 1 mg/L is generally considered to be a positive indicator of sewage contamination. Ammonia can be analyzed in the field using a portable spectrophotometer, which allows for fairly rapid results and the ability to immediately track down sources and improper connections (see Chapter 13 for details on tracking down illicit discharges)¹¹. Since ammonia can be measured in the field, crews can get fast results and immediately proceed to track down the source of the discharge using pipe testing methods (see Chapter 13 for details).

As a single parameter, ammonia has some limitations. First, ammonia by itself may not always be capable of identifying sewage discharges, particularly if they are diluted by “clean” flows. Second, while some washwaters and industrial discharges have relatively high ammonia concentrations, not all do, which increases the prospects of false negatives. Lastly, other dry weather discharges, such as non-target irrigation, can also have high ammonia concentrations that can occasionally exceed 1 mg/L. Supplementing ammonia with potassium and looking at the ammonia/potassium ratio is a simple adjustment to the single parameter approach that helps to further and more accurately characterize the discharge. Ratios greater than one indicate a sewage source, while ratios less than or equal to one indicate a washwater source. Potassium is easily analyzed using a probe (Horiba Cardy™ is the recommended probe).

¹¹ In-field analysis may be appropriate when tracking down illicit flows, but it is typically associated with challenging and uncontrollable conditions. Therefore, it is generally recommended that analyses be conducted in a controlled lab setting.

Industrial Flow Benchmark

If a subwatershed has a high density of industrial generating sites, additional indicator parameters may be needed to detect and trace these unique discharges. They are often needed because industrial and commercial generating sites produce discharges that are often not composed of either sewage or washwater. Examples include industrial process water, or wash down water conveyed from a floor drain to the storm drain system.

This guidance identifies seven indicator parameters that serve as industrial flow benchmarks to help identify illicit discharges originating from industrial and other generating sites. The seven indicators (ammonia, color, conductivity, hardness, pH, potassium and turbidity) are used to identify liquid wastes and other industrial discharges that are not always picked up by the Flow Chart Method. Table 45 summarizes typical benchmark concentrations that can distinguish between unique industrial or commercial liquid wastes. Note that two of the seven indicator parameters, ammonia and potassium, are already incorporated into the flow chart method.

Table 46 illustrates how industrial benchmark parameters can be used independently or as a supplement to the flow chart method, based on data from Alabama (Appendix E). The best industrial benchmark parameters are identified in pink shading and can distinguish industrial sources from residential washwater in 80% of samples. Supplemental indicator parameters denoted by yellow shading, can distinguish industrial source from residential washwater in 50% of samples, or roughly one in two samples.

Most industrial discharges can consistently be identified by extremely high potassium levels. However, these discharges would be misclassified as washwater when just the Flow Chart Method is used. Other benchmark parameters have value in identifying specific industrial types or operations. For example, metal plating bath waste discharges are often indicated by extremely high conductivity, hardness and potassium concentrations.

Adapting Industrial Flow Benchmark

By their very nature, industrial and other generating sites can produce a bewildering diversity of discharges that are hard to classify. Therefore, program managers will experience some difficulty in differentiating industrial sources. Over time, the composition of industrial discharges can be refined as chemical libraries for specific industrial flow types and sources are developed. This can entail a great deal of sampling, but can reduce the number of false positive or negative readings.

Table 45: Benchmark Concentrations to Identify Industrial Discharges

Indicator Parameter	Benchmark Concentration	Notes
Ammonia	≥50 mg/L	<ul style="list-style-type: none"> Existing “Flow Chart” Parameter Concentrations higher than the benchmark can identify a few industrial discharges.
Color	≥500 Units	<ul style="list-style-type: none"> Supplemental parameter that identifies a few specific industrial discharges. Should be refined with local data.
Conductivity	≥2,000 μS/cm	<ul style="list-style-type: none"> Identifies a few industrial discharges May be useful to distinguish between industrial sources.
Hardness	≤10 mg/L as CaCO ₃ ≥2,000 mg/L as CaCO ₃	<ul style="list-style-type: none"> Identifies a few industrial discharges May be useful to distinguish between industrial sources.
pH	≤5	<ul style="list-style-type: none"> Only captures a few industrial discharges High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well.
Potassium	≥20 mg/L	<ul style="list-style-type: none"> Existing “Flow Chart” Parameter Excellent indicator of a broad range of industrial discharges.
Turbidity	≥1,000 NTU	<ul style="list-style-type: none"> Supplemental parameter that identifies a few specific industrial discharges. Should be refined with local data.

Table 46: Usefulness of Various Parameters to Identify Industrial Discharges											
Industrial Benchmark Concentration	Detergents as Surfactants (mg/L)	Ammonia (mg/L)	Potassium (mg/L)	Initial "Flow Chart" Class	Color (Units)	Conductivity (:S/cm) ¹	Hardness (mg/L as CaCO ₃)	pH	Turbidity (NTU)	Best Indicator Parameters to Identify This Flow Type	Additional Indicator Parameters to Identify This Flow Type
Concentrations in Industrial and Commercial Flow Types											
Automotive Manufacturer ¹	5	0.6	66	Wash water	15	220	30	6.7	118	Potassium	
Poultry Supplier ¹	5	4.2	41	Wash water	23	618	31	6.3	111	Potassium	
Roofing Product Manufacturing ¹	8	10.2	27	Wash water	>100 ²	242	32	7.1	229	None	Potassium Color
Uniform Manufacturing ¹	6	6.1	64	Wash water	>100 ²	798	35	10.4	2,631	Potassium	Color Turbidity
Radiator Flushing	15	(26.3)	(2,801)	Wash water	(3,000)	(3,278)	(5.6)	(7.0)	-	Potassium Conductivity Color	Hardness
Metal Plating Bath	7	(65.7)	(1,009)	Wash water	(104)	(10,352)	(1,429)	(4.9)	-	Ammonia Potassium Conductivity Hardness	pH
Commercial Car Wash	140	0.9; (0.2)	4; (43)	Wash water	>61; (222)	274; (485)	71; (157)	7.7; (6.7)	156		Potassium Turbidity
Commercial Laundry	(27)	(0.8)	3	Wash water	47	(563)	(36)	(9.1)	-		
<p>Best Indicators, shaded in pink, distinguish this source from residential wash water in 80% of samples in both Tuscaloosa and Birmingham, AL. Supplemental indicators, shaded in yellow, distinguish this source from residential wash water in 50% of samples, or in only one community.</p> <p>(Data in parentheses are mean values from Birmingham); Data not in parentheses are from Tuscaloosa</p> <p>¹ Fewer than 3 samples for these discharges.</p> <p>² The color analytical technique used had a maximum value of 100, which was exceeded in all samples. Color may be a good indicator of these industrial discharges and the benchmark concentration may need adjustment downward for this specific community.</p>											

Chemical Mass Balance Model (CMBM) for Blended Flows

The Chemical Mass Balance Model (CMBM) is a sophisticated technique to identify flow types at outfalls with blended flows (i.e., dry weather discharges originating from multiple sources). The CMBM, developed by Karri (2004) as part of this project is best applied in complex sewersheds with large drainage areas, and relies heavily on the local chemical library discussed in **the next section**.

The CMBM can quantify the fraction of each flow type present in dry weather flow at an outfall (e.g., 20% spring water; 40% sewage; 20% wash water). The CMBM relies on a computer program that generates and solves algebraic mass balance equations, based on the statistical distribution of specific flow types derived from the chemical library. The CMBM is an excellent analysis tool, but requires significant advance preparation and sampling support. More detailed guidance on how to use and interpret CMBM data can be found in Appendix I.

The chemical library requires additional statistical analysis to support the CMBM. Specifically, indicator parameter data for each flow type need to be statistically analyzed to determine the **mean**, the **coefficient of variation**, and the **distribution type**. In its current version, the CMBM accepts two distribution types: normal or lognormal distributions. Various statistical methodologies can determine the distribution type of a set of data. Much of this analysis can be conducted using standard, readily-available statistical software, such as the Engineering Statistics Handbook which is available from the National Institute of Standards and Technology, and can be accessed at <http://www.itl.nist.gov/div898/handbook/>.

12.5 The Chemical Library

The chemical library is a summary of the chemical composition of the range of discharge types found in a community. The primary purpose of the library is to characterize distinct flow types that may be observed at outfalls, including both clean and contaminated discharges. A good library includes data on the composition of tap water, groundwater, sewage, septage, non-target irrigation water, industrial process waters, and washwaters (e.g., laundry, car wash, etc.). The chemical library helps program managers customize the flow chart method and industrial benchmarks, and creates the input data needed to drive the CMBM.

To develop the library, samples are collected directly from the discharge source (e.g., tap water, wastewater treatment influent, shallow wells, septic tanks, etc.). Table 47 provides guidance on how and where to sample each flow type in your community. As a general rule, about 10 samples are typically needed to characterize each flow type, although more samples may be needed if the flow type has a high coefficient of variation. The measure of error can be statistically defined by evaluating the coefficient of variation of the sample data (variability relative to the mean value), and the statistical distribution for the data (the probable spread in the data beyond the mean). For more guidance on statistical techniques for assessing sampling data, consult Burton and Pitt (2002) and US EPA (2002), which can be accessed at <http://galton.uchicago.edu/~cises/resources/EPA-QA-Sampling-2003.pdf>.

Chemical libraries should also be compared to databases that summarize indicator monitoring of dry weather flows at suspect

outfalls. Outfall samples may not always be representative of individual flow types because of mixing of flows and dilution, but they can serve as a valuable check if the discharge source is actually confirmed. Program managers can also use both the chemical library and indicator database to refine flow chart or industrial benchmarks (see Appendix J for an example).

Over time, communities may want to add other flow types to the chemical library, such as transitory discharges that generate small volume flows such as “dumpster juice,” power washing and residential car washing. Transitory discharges are hard to detect with outfall monitoring, but may cumulatively contribute significant dry weather loads. Understanding the chemical makeup of the transitory discharges can help program managers prioritize education and pollution prevention efforts.

Table 47: Where and How to Sample for Chemical “Fingerprint” Library

Flow Type	Places to Collect the Data	Any Other Potential Sources?
Shallow Groundwater	<ul style="list-style-type: none"> From road cuts or stream banks Samples from shallow wells USGS regional groundwater quality data Dry weather in-stream flows at headwaters with no illicit discharges 	None. Locally distinct.
Spring Water	<ul style="list-style-type: none"> Directly from springs 	None. Locally distinct.
Tap water	<ul style="list-style-type: none"> Individual taps throughout the community or analyze local drinking water monitoring reports or annual consumer confidence reports 	None. Locally distinct.
Irrigation	<ul style="list-style-type: none"> Collect irrigation water from several different sites. May require a hand operated vacuum pump to collect these shallow flows (see Burton and Pitt, 2002) 	None. Locally distinct.
Sewage	<ul style="list-style-type: none"> Reported sewage treatment plant influent data provides a characterization of raw sewage and is usually available from discharge monitoring reports. Because the characteristics of sewage will vary within the collection system depending upon whether the area is serving residential or commercial uses, climate, residence time in the collection system, etc, it is often more accurate and valuable to collect “fingerprint” samples from within the system, rather than at the treatment plant. 	Data in Appendix E can provide a starting point, but local data are preferred.
Septage	<ul style="list-style-type: none"> Outflow of several individual septic tanks or leach fields 	
Most Industrial Discharges	<ul style="list-style-type: none"> Direct effluent from the industrial process (Obtain samples as part of industrial pre-treatment program in local community) 	Data in Appendix E characterize some specific industrial flows. Industrial NPDES permit monitoring can also be used.
Commercial Car Wash; Commercial Laundry	<ul style="list-style-type: none"> Sumps at these establishments 	Data in Appendix E can provide a starting point, but local data are preferred.

Evaluating Interpretive Techniques Using Outfall Indicator Monitoring Data

Outfall sampling data for confirmed sources or flow types can be used to test the accuracy and reliability of all four interpretive techniques. The sampling record is used to determine the number of false positives or false negatives associated with a specific interpretive technique. A simple tabulation of false test readings can identify the types and levels of indicator parameters that are most useful.

Table 48 provides an example of how the Flow Chart Method was tested with outfall monitoring data from Birmingham, AL (Pitt *et al.*, 1993). In this case, the Flow Chart Method was applied without adaptation to local conditions, and the number of correctly (and incorrectly) identified discharges was tracked. Tests on 10 Birmingham outfalls were mostly favorable, with the flow chart method correctly identifying contaminated discharges in all cases (i.e., washwater or sewage waste water). At one outfall, the flow chart incorrectly identified sewage as washwater, based on an ammonia (NH₃)/potassium (K) ratio of 0.9 that was very close to the breakpoint in the Flow Chart Method (ratio of one). Based on such tests, program managers may want to slightly adjust the breakpoints in the Flow Chart Method to minimize the occurrence of errors.

12.6 Special Monitoring Techniques for Intermittent or Transitory Discharges

The hardest discharges to detect and test are intermittent or transitory discharges to the storm drain system that often have an indirect mode of entry. With some ingenuity, luck, and specialized sampling techniques, however, it may be possible to catch these discharges. This section describes some specific monitoring techniques to track down intermittent discharges. Transitory discharges cannot be reliably detected using conventional outfall monitoring techniques, and are normally found as a result of hotline complaints or spill events. Nevertheless, when transitory discharges are encountered, they should be sampled if possible.

Techniques for Monitoring Intermittent Discharges

An outfall may be suspected of having intermittent discharges based on physical indicators (e.g., staining), poor in-stream dry weather water quality, or the density of generating sites in the contributing subwatershed. The only sure way to detect an intermittent discharge is to camp out at the outfall for a long period of time, which is obviously not very cost-effective or feasible. As an alternative, five special monitoring techniques can be used to help track these elusive problems:

- Odd hours monitoring
- Optical brightener monitoring traps
- Caulk dams
- Pool sampling
- Toxicity monitoring

Table 48: Evaluation of the Flow Chart Method Using Data from Birmingham, Alabama
(Adapted from Pitt et al., 1993)

Outfall ID	Outfall Concentrations (mg/L)					Predicted Flow Type	Confirmed Flow Type	Result
	Detergents-Surfactants (>0.25 is sanitary or wash water)	NH ₃	K	NH ₃ /K (>1.0 is sanitary)	Fluoride (>0.25 is tap, if no detergents)			
14	0	0	0.69	0.0	0.04	Natural Water	Spring Water	Correct
20	0	0.03	1.98	0.0	0.61	Tap Water	Rinse Water (Tap) and Spring Water	Correct
21	20	0.11	5.08	0.0	2.80	Washwater	Washwater (Automotive)	Correct
26	0	0.01	0.72	0.0	0.07	Natural Water	Spring Water	Correct
28	0.25 ¹	2.89	5.96	0.5	0.74	Washwater	Washwater (Restaurant)	Correct
31	0.95	0.21	3.01	0.1	1.00	Washwater	Laundry (Motel)	Correct
40z	0.25 ¹	0.87	0.94	0.9	0.12	Washwater	Shallow Groundwater and Septage	Identifies Contaminated but Incorrect Flow Type
42	0	0	0.81	0.0	0.07	Natural Water	Spring Water	Correct
48	3.0	5.62	4.40	1.3	0.53	Sanitary Wastewater	Spring Water and Sewage	Correct
60a	0	0.31	2.99	0.1	0.61	Tap Water	Landscaping Irrigation Water	Correct

¹ These values were increased from reported values of 0.23 mg/L (outfall 28) and 0.2 mg/L (outfall 40z). The analytical technique used in Birmingham was more precise (but more hazardous) than the method used to develop the flow chart in Figure 47. It is assumed that these values would have been interpreted as 0.25 mg/L using the less precise method.

Odd Hours Monitoring

Many intermittent discharges actually occur on a regular schedule, but unfortunately not the same one used by field crews during the week. For example, some generating sites discharge over the weekend or during the evening hours. If an outfall is deemed suspicious, program managers may want to consider scheduling “odd hours” sampling at different times of the day or week. Some key times to visit suspicious outfalls include:

- Both morning and afternoon

- Weekday evenings
- Weekend mornings and evenings

Optical Brightener Monitoring Traps

Optical brightener monitoring (OBM) traps are another tool that crews can use to gain insight into the “history” of an outfall without being physically present. OBM traps can be fabricated and installed using a variety of techniques and materials. All configurations involve an absorbent, unbleached cotton pad or fabric swatch and a holding or anchoring device such as

a wire mesh trap (Figure 48) or a section of small diameter (e.g., 2-inch) PVC pipe. Traps are anchored to the inside of outfalls at the invert using wire or monofilament that is secured to the pipe itself or rocks used as temporary weights.

Field crews retrieve the OBM traps after they have been deployed for several days of dry weather, and place them under a fluorescent light that will indicate if they have been exposed to detergents. OBM traps have been used with some success in Massachusetts (Sargent *et al.*, 1998) and northern Virginia (Way, 2000). Although each community used slightly different methods, the basic sampling concept is the same. For more detailed guidance on how to use OBM traps and interpret the results, consult the guidance manual found at: <http://www.naturecompass.org/8tb/sampling/index.html> and <http://www.novaregion.org/obm.htm>.

Although OBM traps appear useful in detecting some intermittent discharges, research during this project has found that OBM traps only pick up the most contaminated discharges, and the detergent level needed to produce a “hit” was roughly similar to pure washwater from a washing machine (see Appendix F for results).

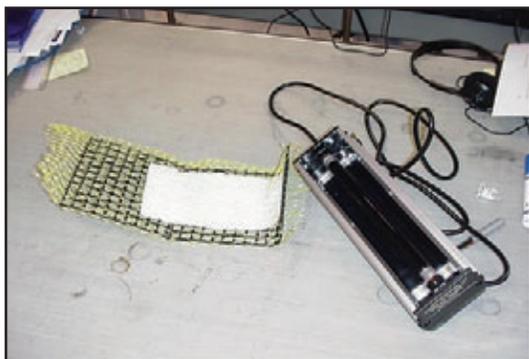


Figure 48: OBM Equipment includes a black light and an OBM Trap that can be placed at an outfall

Source: R. Pitt

Consequently, OBM traps may be best suited as a simple indicator of presence or absence of intermittent flow or to detect the most concentrated flows. OBM traps need to be retrieved before runoff occurs from the outfalls, which will contaminate the trap or wash it away.

Caulk Dams

This technique uses caulk, plumber’s putty, or similar substance to make a dam about two inches high within the bottom of the storm drain pipe to capture any dry weather flow that occurs between field observations. Any water that has pooled behind the dam is then sampled using a hand-pump sampler, and analyzed in the lab for appropriate indicator parameters.

Pool Sampling

In this technique, field crews collect indicator samples directly from the “plunge pool” below an outfall, if one is present. An upstream sample is also collected to characterize background stream or ditch water quality that is not influenced by the outfall. The pool water and stream sample are then analyzed for indicator parameters, and compared against each other. Pool sampling results can be constrained by stream dilution, deposition, storm water flows, and chemical reactions that occur within the pool.

Toxicity Monitoring

Another way to detect intermittent discharges is to monitor for toxicity in the pool below the outfall on a daily basis. Burton and Pitt (2002) outline several options to measure toxicity, some of which can be fairly expensive and complex. The Fort Worth Department of Environmental Management has developed a simple low-cost outfall toxicity testing technique known as the Stream Sentinel program. Stream sentinels

place a bottle filled with minnows in the pool below suspected outfalls and measure the survival rate of the minnows as an indicator of the toxicity of the outfall¹² (see Figure 49).

One advantage of the sentinel program is that volunteer monitors can easily participate, by raising and caring for the minnows, placing bottles at outfalls, and visiting them everyday to record mortality. The long-term nature of sentinel monitoring can help pick up toxicity trends at a given outfall. For example, Fort Worth observed a trend of mass mortality on the second Tuesday of each month at some outfalls, which helped to pinpoint the industry responsible for the discharges, and improved

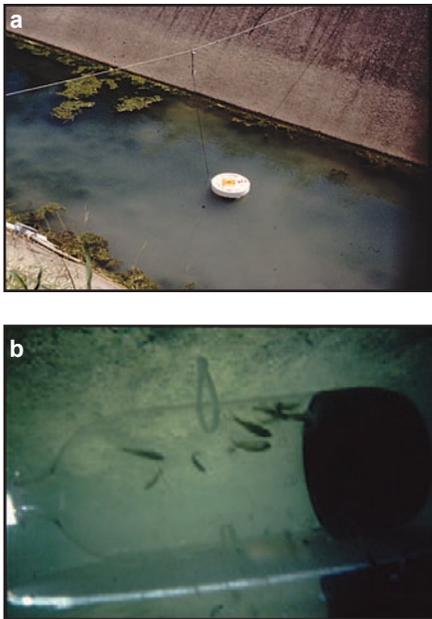


Figure 49: Float and wire system to suspend a bottle in a stream sentinel station deployed in Fort Worth, TX (a); Minnows in the perforated bottle below the water surface (b).

sample scheduling (City of Fort Worth, 2003). More information about the Stream Sentinel program can be found at: www.fortworthgov.org/DEM/stream_sentinel.pdf.

Due to the cost and difficulty of interpreting findings, toxicity testing is generally not recommended for communities unless they have prior experience and expertise with the method.

Techniques for Monitoring Transitory Discharges

Transitory discharges, such as spills and illegal dumping, are primarily sampled to assign legal responsibility for enforcement actions or to reinforce ongoing pollution prevention education efforts. In most cases, crews attempt to trace transitory discharges back up the pipe or drainage area using visual techniques (see Chapter 13). However, field crews should always collect a sample to document the event. Table 49 summarizes some follow-up monitoring strategies to document transitory discharges.

12.7 Monitoring of Stream Quality During Dry Weather

In-stream water quality monitoring can help detect sewage and other discharges in a community or larger watershed. Stream monitoring can identify the subwatersheds with the greatest illicit or sewage discharge potential that is then used to target outfall indicator monitoring. At the smaller reach scale, stream monitoring may sometimes detect major individual discharges to the stream.

¹² It may be necessary to obtain approval from the appropriate state or federal regulatory agency before conducting toxicity monitoring using vertebrates.

Table 49: Follow-Up Monitoring for Transitory Discharges

Condition	Response
Oils or solvents	Special hydrocarbon analysis to characterize the source of the oil
Unknown but toxic material	Full suite of metals, pesticides, other toxic materials
Probable sewage	Monitor for parameters associated with the Flow Chart Technique (detergents, ammonia, potassium, fluoride) for residential drainage areas

Stream Monitoring to Identify Problem Reaches or Subwatersheds

Stream monitoring data can be used to locate areas in subwatersheds where illicit discharges may be present, and where human or aquatic health risks are higher. To provide this information, stream monitoring should be conducted regularly during dry weather conditions to track water quality (at least monthly) and to document changes in water quality over a period of time. Stream monitoring data are particularly effective when combined with ORI data. For example, a subwatershed with many ORI physical indicators of illicit discharges (e.g., a high number of flowing outfalls) that also has poor stream water quality would be an obvious target for intensive outfall monitoring.

Stream monitoring parameters should reflect local water quality goals and objectives, and frequently include bacteria and ammonia. Bacteria are useful since sewage discharges can contribute to violations of water contact standards set for recreation during dry weather conditions. Table 50 summarizes water quality standards for *E. coli* that EPA recommends for water contact recreation. It is important to note that individual states may use different action levels or bacteria indicators (e.g., Enterococci or fecal coliform) to regulate water contact recreation. For a review of the impacts bacteria exert on surface waters, consult CWP (2000).

An important caveat when interpreting stream monitoring data is that a violation of bacteria standards during dry weather flow does not always mean that an illicit discharge or sewage overflow is present. While raw sewage has bacteria concentrations that greatly exceed bacteria standards (approximately 12,000 MPN/100 mL) other bacteria sources, such as urban wildlife, can also cause a stream to violate standards. Consequently, stream monitoring data need to be interpreted in the context of other information, such as upstream land use, past complaints, age of infrastructure, and ORI surveys.

Ideally, stream monitoring stations should be strategically located with a minimum of one station per subwatershed, and additional stations at stream confluences and downstream of reaches with a high outfall density. Stations should also be located at beaches, shellfish harvesting and other areas where discharges represent a specific threat to public health. See Burton and Pitt (2002) for guidance on stream monitoring.

Stream Monitoring to Identify Specific Discharges

Stream monitoring data can help field crews locate individual discharges within a specific stream reach. Immediate results are needed for this kind of monitoring, so indicator parameters should be analyzed using simple field test kits or portable analytical

instruments (e.g., spectrophotometer). Bacteria is not a good indicator parameter to use for this purpose because lab results cannot be received for at least one day (analytical method requires a “hold time” of 24 hours). Table 51 summarizes nutrient indicator parameters along with their “potential problem level” benchmarks. It is important to note that other factors, such as animal operations, can elevate stream nutrient concentrations, so data should always be interpreted in the context of surrounding land use. Stream monitoring benchmarks should be continuously refined as communities develop a better

understanding of what dry weather baseline concentrations to expect.

If stream monitoring indicates that a potential problem level benchmark has been exceeded, field crews continue stream sampling to locate the discharge through a process of elimination. Crews walk upstream taking regular samples above and below stream confluences until the benchmark concentration declines. The crews then take samples at strategic points to narrow down the location of the discharge, using the in-pipe monitoring strategy described in Chapter 13.

Table 50: Typical “Full Body Contact Recreation” Standards for *E. coli*

(Source: EPA, 1986)¹

Use	Criterion
Designated beach area	235 MPN /100 mL
Moderately-used full body contact recreation area	298 MPN /100 mL
Lightly-used full body contact recreation	406 MPN /100 mL
Infrequently-used full body contact recreation	576 MPN /100 mL

¹ These concentrations represent standards for a single sampling event. In all waters, a geometric mean concentration of 126 MPN/100 mL cannot be exceeded for five samples taken within one month.

Table 51: Example In-Stream Nutrient Indicators of Discharges

(Zielinski, 2003)

Parameter	Potential Problem Level*	Possible Cause of Water Quality Problem
Total Nitrogen (TN)	3.5 mg/l	High nutrients in ground water from agriculture, lawn practices, or sewage contamination from illicit connection, sanitary line break or failing septic system.
Total Phosphorus (TP)	0.4 mg/l	Contamination from lawn practices, agriculture, sewage or washwater.
Ammonia (NH ₃)	0.3 mg/l	Sewage or washwater contamination from illicit connection, sanitary line break or failing septic system.

*Nutrient parameters are based on USGS NAWQA data with 85% of flow weighted samples being less than these values in urban watersheds (Note: data from Nevada were not used, due to climatic differences and for some parameters they were an order of magnitude higher). Communities can modify these benchmarks to reflect local data and experience.

12.8 The Costs of Indicator Monitoring

This section provides general guidance on scoping and budgeting an indicator monitoring program. The required budget will ultimately be dictated by the monitoring decisions and local conditions within a community. The budgeting data presented in this section are based on the level of indicator sampling effort in two hypothetical communities, using different numbers of samples, indicator parameters, and analysis methods.

Budgets for Indicator Monitoring in a Hypothetical Community

Communities can develop annual budgets for indicator monitoring if the degree of sampling effort can be scoped. This is normally computed based on the expected number of samples to analyze and is a function of stream miles surveyed and outfall density. For example, if a community collects samples from 10 stream miles with eight outfalls per mile, it will have 80 samples to analyze. This number can be used to generate start-up and annual monitoring cost estimates that represent the expected level of sampling effort. Table 52 summarizes how indicator monitoring budgets were developed for two hypothetical communities, each with 80 outfalls to sample. Budgets are shown using both in-house and contract lab set-ups, and are split between initial start-up costs and annual costs.

Community A: Primarily Residential Land Use, Flow Chart Method

In this scenario, six indicator parameters were analyzed, several of which were used to support the Flow Chart Method. The community took no additional samples to create a chemical library, and instead

relied on default values to identify illicit discharges. The community analyzed the samples in-house at a rate of one sample (includes analysis of all six parameters) per staff hour.

Community B: Mixed Land Use - Multiple Potential Sources, Complex Analysis

In the second scenario, the community analyzed 11 indicator parameters, including a bacteria indicator, and took samples of eight distinct flow types to create a chemical library, for a total of 88 samples. The community analyzed the samples in-house at a rate of one sample per 1.5 staff hours.

Some general rules of thumb that were used for this budget planning example include the following:

- \$500 in initial sampling equipment (e.g., sample bottles, latex gloves, dipper, cooler, etc).
- Outfall samples are collected in batches of 10. Each batch of samples can be collected and transported to the lab in two staff days (two-person crew required to collect samples for safety purposes).
- Staff rate is \$25/hr.
- Overall effort to collect samples for the chemical library and statistically analyze the data is approximately one staff day per source type.
- The staff time needed to prepare for field work and interpret lab results is roughly two times that required for conducting the field work (i.e., eight days of collecting samples requires 16 days of pre- and post-preparation).

Costs for Intermittent Discharge Analyses

Equipment costs for most specialized intermittent discharge techniques tend to be low (<\$500), and are dwarfed by staff effort. As a rule of thumb, assume about four hours

of staff time to deploy, retrieve and analyze samples collected from a single outfall using these techniques.

Table 52: Indicator Monitoring Costs: Two Scenarios				
	Community A: In-House	Community A: Contract Lab	Community B: In-House	Community B: Contract Lab
Initial Costs				
Initial Sampling Supplies and Lab Equipment ¹	\$1,700	\$500	\$7,500	\$500
Staff Cost: Library Development ²	\$0	\$0	\$4,600 ³	\$2,000
Analysis Costs: Library Development (Reagents or Contract Lab Cost)	\$0	\$0	\$1,400	\$13,000 ⁴
Total Initial Costs	\$1,700	\$500	\$13,500	\$15,500
Annual Costs in Subsequent Years				
Staff Field Cost (Sample Collection) ^{2, 5, 6}	\$3,200	\$3,200	\$3,200	\$3,200
Staff Costs: Chemical Analysis ²	\$2,000	\$200 ⁷	\$3,000	\$200
Staff Time to Enter/ Interpret Data ^{2, 6}	\$3,200	\$3,200	\$4,800	\$4,800
Analysis Costs: Annual Outfall Sampling (Reagents or Contract Lab Cost)	\$600	\$8,400 ⁴	\$1,400	\$13,000 ⁴
Total Annual Cost	\$9,000	\$15,000	\$12,400	\$21,200
<p><i>Notes:</i></p> <p>¹ \$500 in initial sampling equipment.</p> <p>² Samples can be shipped to a contract lab using one staff hour.</p> <p>³ Overall effort to collect samples for the library and statistically analyze the data is approximately one staff day per source type.</p> <p>⁴ For contract lab analysis, assume a cost that is an average between the two extremes of the range in Table 43.</p> <p>⁵ Outfall samples are collected in batches of 10. Each batch of samples can be collected and transported to the lab in two staff days (two-person crew required to collect samples for safety purposes).</p> <p>⁶ Assume that the staff time needed to interpret lab results and prepare for field work is roughly 16 staff days. An additional eight days are required for the flow type pre- and post-preparation for Community 2.</p> <p>⁷ Staff rate is \$25/hr.</p>				

Chapter 13: Tracking Discharges To A Source

Once an illicit discharge is found, a combination of methods is used to isolate its specific source. This chapter describes the four investigation options that are introduced below.

Storm Drain Network Investigation

Field crews strategically inspect manholes within the storm drain network system to measure chemical or physical indicators that can isolate discharges to a specific segment of the network. Once the pipe segment has been identified, on-site investigations are used to find the specific discharge or improper connection.

Drainage Area Investigation

This method relies on an analysis of land use or other characteristics of the drainage area that is producing the illicit discharge. The investigation can be as simple as a “windshield” survey of the drainage area or a more complex mapping analysis of the storm drain network and potential generating sites. Drainage area investigations work best when prior indicator monitoring reveals strong clues as to the likely generating site producing the discharge.

On-site Investigation

On-site methods are used to trace the source of an illicit discharge in a pipe segment, and may involve dye, video or smoke testing within isolated segments of the storm drain network.

Septic System Investigation

Low-density residential watersheds may require special investigation methods if

they are not served by sanitary sewers and/or storm water is conveyed in ditches or swales. The major illicit discharges found in low-density development are failing septic systems and illegal dumping. Homeowner surveys, surface inspections and infrared photography have all been effectively used to find failing septic systems in low-density watersheds.

13.1 Storm Drain Network Investigations

This method involves progressive sampling at manholes in the storm drain network to narrow the discharge to an isolated pipe segment between two manholes. Field crews need to make two key decisions when conducting a storm drain network investigation—where to start sampling in the network and what indicators will be used to determine whether a manhole is considered clean or dirty.

Where to Sample in the Storm Drain Network

The field crew should decide how to attack the pipe network that contributes to a problem outfall. Three options can be used:

- Crews can work progressively up the trunk from the outfall and test manholes along the way.
- Crews can split the trunk into equal segments and test manholes at strategic junctions in the storm drain system.
- Crews can work progressively down from the upper parts of the storm drain network toward the problem outfall.

The decision to move up, split, or move down the trunk depends on the nature and land use of the contributing drainage area. Some guidance for making this decision is provided in Table 53. Each option requires different levels of advance preparation. Moving up the trunk can begin immediately when an illicit discharge is detected at the outfall, and only requires a map of the storm drain system. Splitting the trunk and moving down the system require a little more preparation to analyze the storm drain map to find the critical branches to strategically sample manholes. Accurate storm drain maps are needed for all three options. If good mapping is not available, dye tracing

can help identify manholes, pipes and junctions, and establish a new map of the storm drain network.

Option 1: Move up the Trunk

Moving up the trunk of the storm drain network is effective for illicit discharge problems in relatively small drainage areas. Field crews start with the manhole closest to the outfall, and progressively move up the network, inspecting manholes until indicators reveal that the discharge is no longer present (Figure 50). The goal is to isolate the discharge between two storm drain manholes.

Table 53: Methods to Attack the Storm Drain Network			
Method	Nature of Investigation	Drainage System	Advance Prep Required
Follow the discharge up	Narrow source of an individual discharge	Small diameter outfall (< 36") Simple drainage network	No
Split into segments	Narrow source of a discharge identified at outfall	Large diameter outfall (> 36"), Complex drainage Logistical or traffic issues may make sampling difficult.	Yes
Move down the storm drain	Multiple types of pollution, many suspected problems—possibly due to old plumbing practices or number of NPDES permits	Very large drainage area (> one square mile).	Yes

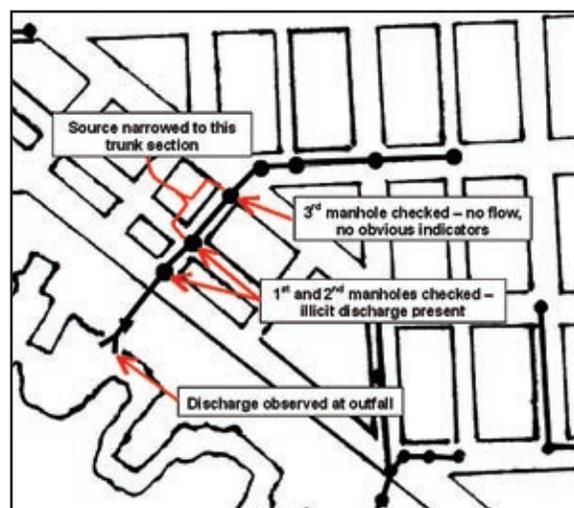


Figure 50: Example investigation following the source up the storm drain system

Option 2: Split the storm drain network

When splitting the storm drain network, field crews select strategic manholes at junctions in the storm drain network to isolate discharges. This option is particularly suited in larger and more complex drainage areas since it can limit the total number of manholes to inspect, and it can avoid locations where access and traffic are problematic.

The method for splitting the trunk is as follows:

1. Review a map of the storm drain network leading to the suspect outfall.
2. Identify major contributing branches to the trunk. The trunk is defined as the largest diameter pipe in the storm drain network that leads directly to the outfall. The “branches” are networks of smaller pipes that contribute to the trunk.
3. Identify manholes to inspect at the farthest downstream node of each contributing branch and one immediately upstream (Figure 51).
4. Working up the network, investigate manholes on each contributing branch and trunk, until the source is narrowed to a specific section of the trunk or contributing branch.
5. Once the discharge is narrowed to a specific section of trunk, select the appropriate on-site investigation method to trace the exact source.
6. If narrowed to a contributing branch, move up or split the branch until a specific pipe segment is isolated, and commence the appropriate on-site investigation to determine the source.

Option 3: Move down the storm drain network

In this option, crews start by inspecting manholes at the “headwaters” of the storm drain network, and progressively move down pipe. This approach works best in very large drainage areas that have many potential continuous and/or intermittent discharges. The Boston Water and Sewer Commission has employed the headwater option to investigate intermittent discharges in complex drainage areas up to three square miles (Jewell, 2001). Field crews certify that each upstream branch of the storm drain network has no contributing discharges before moving down pipe to a “junction manhole” (Figure 52). If discharges are found, the crew performs dye testing to pinpoint the discharge. The crew then confirms that the discharge is removed before moving farther down the pipe network. Figure 53 presents a detailed flow chart that describes this option for analyzing the storm drain network.

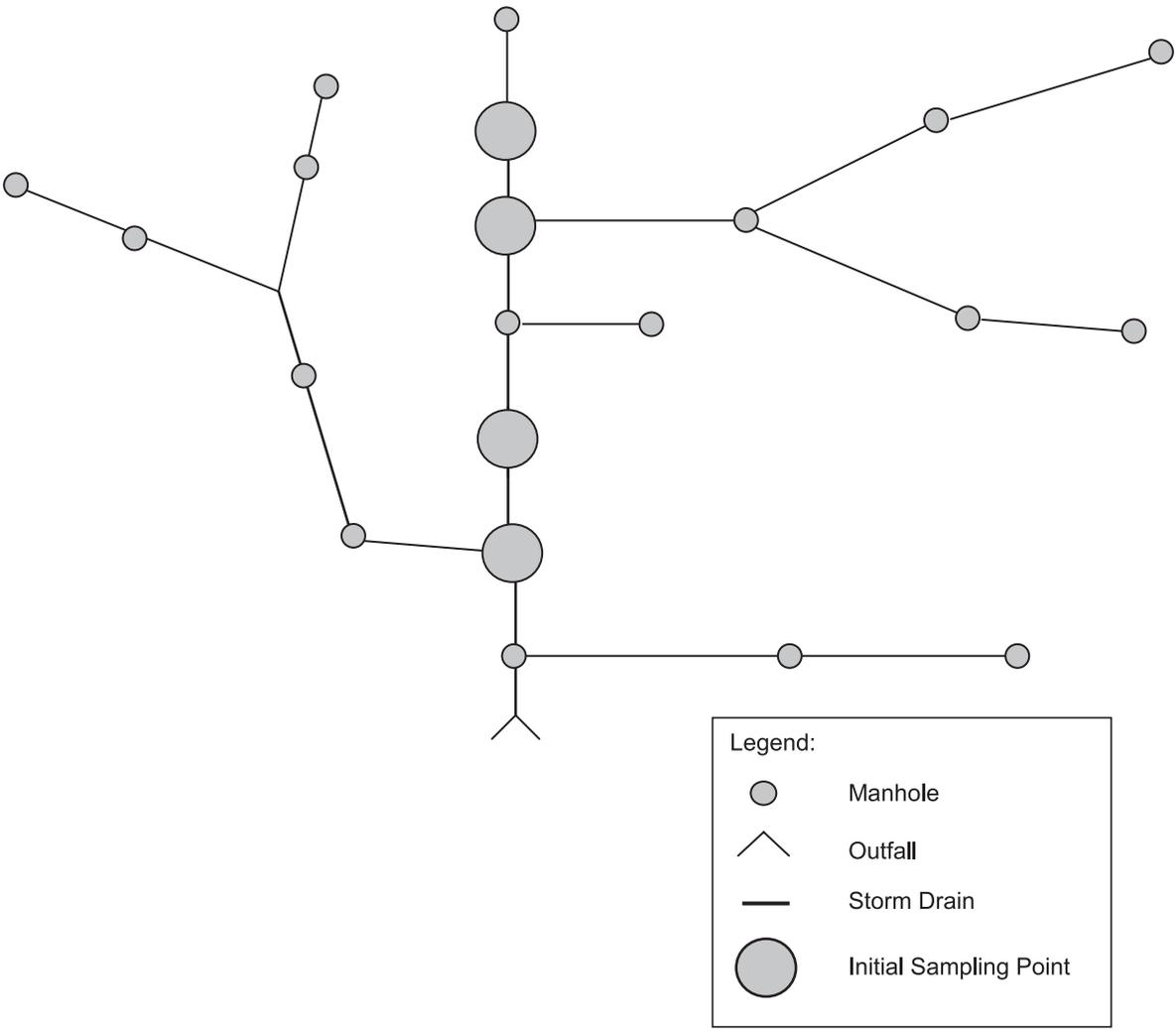


Figure 51: Key initial sampling points along the trunk of the storm drain

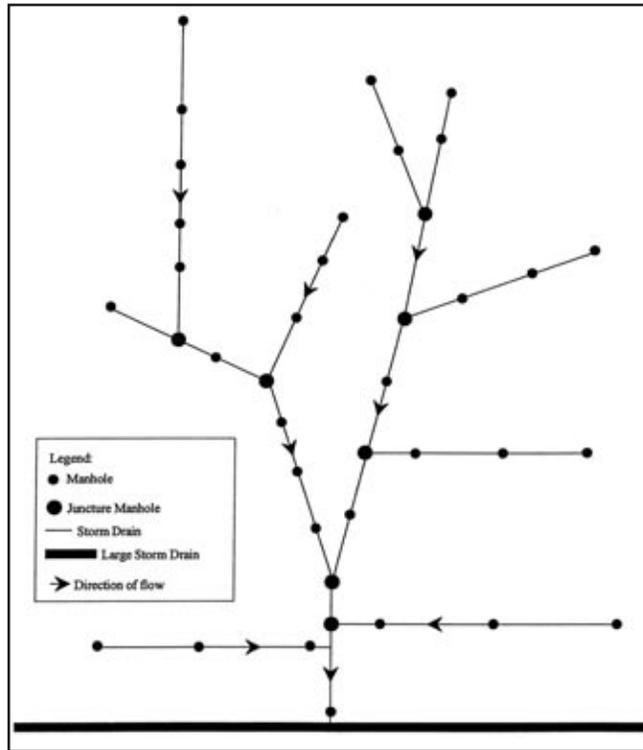


Figure 52: Storm Drain Schematic Identifying “Juncture Manholes” (Source: Jewell, 2001)

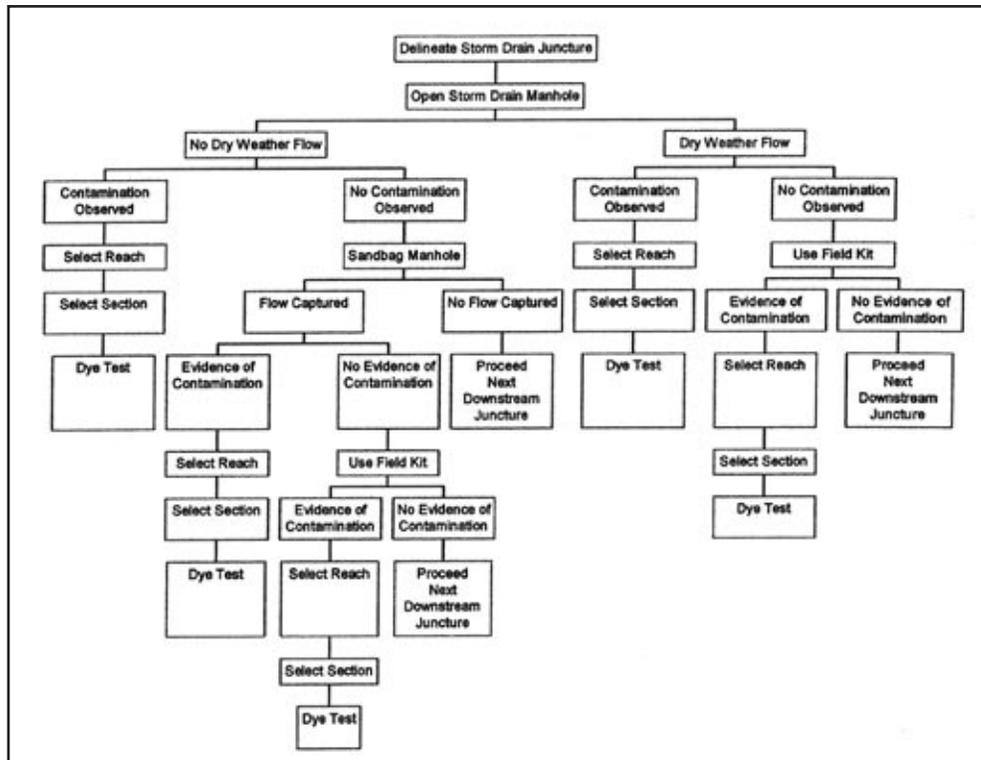


Figure 53: A Process for Following Discharges Down the Pipe (Source: Jewell, 2001)

Dye Testing to Create a Storm Drain Map

As noted earlier, storm drain network investigations are extremely difficult to perform if accurate storm drain maps are not available. In these situations, field crews may need to resort to dye testing to determine the flowpath within the storm drain network. Fluorescent dye is introduced into the storm drain network and suspected manholes are then inspected to trace the path of flow through the network (U.S. EPA, 1990). Two or three member crews are needed for dye testing. One person drops the dye into the trunk while the other(s) looks for evidence of the dye down pipe.

To conduct the investigation, a point of interest or down pipe “stopping point” is identified. Dye is then introduced into manholes upstream of the stopping point to determine if they are connected. The process continues in a systematic manner until an upstream manhole can no longer be determined, whereby a branch or trunk of the system can be defined, updated or corrected. More information on dye testing methods is provided in Section 13.3.

Manhole Inspection: Visual Observations and Indicator Sampling

Two primary methods are used to characterize discharges observed during manhole inspections—visual observations and indicator sampling. In both methods, field crews must first open the manhole to determine whether an illicit discharge is present. Manhole inspections require a crew of two and should be conducted during dry weather conditions.

Basic field equipment and safety procedures required for manhole inspections are outlined

in Table 54. In particular, field crews need to be careful about how they will safely divert traffic (Figure 54). Other safety considerations include proper lifting of manhole covers to reduce the potential for back injuries, and testing whether any toxic or flammable fumes exist within the manhole before the cover is removed. Wayne County, MI has developed some useful operational procedures for inspecting manholes, which are summarized in Table 55.

• Camera and film or digital camera	• Storm drain, stream, and street maps
• Clipboards	• Reflective safety vests
• Field sheets	• Rubber / latex gloves
• Field vehicle	• Sledgehammer
• First aid kit	• Spray paint
• Flashlight or spotlight	• Tape measures
• Gas monitor and probe	• Traffic cones
• Manhole hook/crow bar	• Two-way radios
• Mirror	• Waterproof marker/pen
• Hand held global positioning satellite (GPS) system receiver (best resolution available within budget, at least 6' accuracy)	



Figure 54: Traffic cones divert traffic from manhole inspection area

Table 55: Field Procedure for Removal of Manhole Covers*(Adapted from: Pomeroy et al., 1996)***Field Procedures:**

1. Locate the manhole cover to be removed.
2. Divert road and foot traffic away from the manhole using traffic cones.
3. Use the tip of a crowbar to lift the manhole cover up high enough to insert the gas monitor probe. Take care to avoid creating a spark that could ignite explosive gases that may have accumulated under the lid. Follow procedures outlined for the gas monitor to test for accumulated gases.
4. If the gas monitor alarm sounds, close the manhole immediately. Do not attempt to open the manhole until some time is allowed for gases to dissipate.
5. If the gas monitor indicates the area is clear of hazards, remove the monitor probe and position the manhole hook under the flange. Remove the crowbar. Pull the lid off with the hook.
6. When testing is completed and the manhole is no longer needed, use the manhole hook to pull the cover back in place. Make sure the lid is settled in the flange securely.
7. Check the area to ensure that all equipment is removed from the area prior to leaving.

Safety Considerations:

1. Do not lift the manhole cover with your back muscles.
2. Wear steel-toed boots or safety shoes to protect feet from possible crushing injuries that could occur while handling manhole covers.
3. Do not move manhole covers with hands or fingers.
4. Wear safety vests or reflective clothing so that the field crew will be visible to traffic.
5. Manholes may only be entered by properly trained and equipped personnel and when all OSHA and local rules apply.

Visual Observations During Manhole Inspection

Visual observations are used to observe conditions in the manhole and look for any signs of sewage or dry weather flow. Visual observations work best for obvious illicit discharges that are not masked by groundwater or other “clean” discharges, as shown in Figure 55. Typically, crews progressively inspect manholes in the storm drain network to look for contaminated

flows. Key visual observations that are made during manhole inspections include:

- Presence of flow
- Colors
- Odors
- Floatable materials
- Deposits or stains (intermittent flows)



Figure 55: Manhole observation (left) indicates a sewage discharge. Source is identified at an adjacent sewer manhole that overflowed into the storm drain system (right).

Indicator Sampling

If dry weather flow is observed in the manhole, the field crew can collect a sample by attaching a bucket or bottle to a tape measure/rope and lowering it into the manhole (Figure 56). The sample is then immediately analyzed in the field using probes or other tests to get fast results as to whether the flow is clean or dirty. The most common indicator parameter is ammonia, although other potential indicators are described in Chapter 12.

Manhole indicator data is analyzed by looking for “hits,” which are individual samples that exceed a benchmark concentration. In addition, trends in indicator concentrations are also examined throughout the storm drain network.



Figure 56: Techniques to sample from the storm drain

Figure 57 profiles a storm drain network investigation that used ammonia as the indicator parameter and a benchmark concentration of 1.0 mg/L. At both the outfall and the first manhole up the trunk, field crews recorded finding “hits” for ammonia of 2.2 mg/L and 2.3 mg/L, respectively. Subsequent manhole inspections further up the network revealed one manhole with no flow, and a second with a hit for ammonia (2.4 mg/L). The crew then tracked the discharge upstream of the second manhole, and found a third manhole with a low ammonia reading (0.05 mg/L) and a fourth with a much higher reading (4.3 mg/L). The crew then redirected its effort to sample above the fourth manhole with the 4.3 mg/L concentration, only to find another low reading. Based on this pattern, the crew concluded the discharge source was located between these two manholes, as nothing else could explain this sudden increase in concentration over this length of pipe.

The results of storm drain network investigations should be systematically documented to guide future discharge investigations, and describe any infrastructure maintenance problems encountered. An example of a sample manhole inspection field log is displayed in Figure 58.

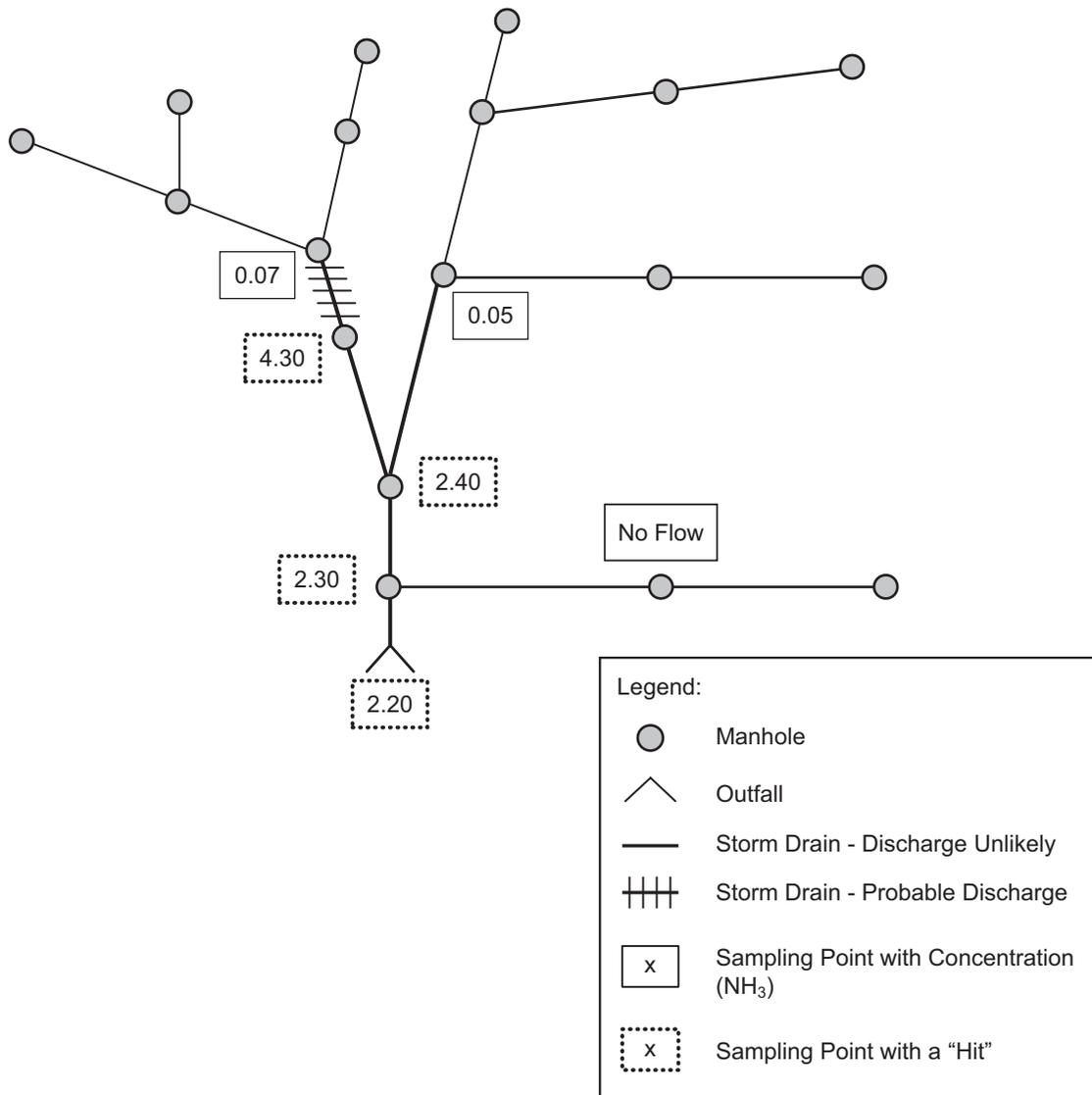


Figure 57: Use of ammonia as a trace parameter to identify illicit discharges



BOSTON WATER AND SEWER COMMISSION
MANHOLE INSPECTION LOG

Manhole ID No.

Inspection Date: _____ Tributary Area: _____

Street: _____ Manhole Type: _____

Inspection: Not Found ___ Surface ___ Internal ___ Sanitary Sewer ___ Storm Drain ___
 Follow Up Inspection ___ High Outlet ___ Lovejoy ___

Time Since Last Rain:
 Inspector: _____ < 48 hours ___ 48 – 72 hours ___ > 72 hours ___

Observations:

Standing Water in Manhole: Yes ___ No ___ Color of Water: Clear ___ Cloudy ___ Other _____

Flow in Manhole: Yes ___ No ___ Velocity: Slow ___ Medium ___ Fast ___ Depth of Flow: _____ in.

Color of Flow: No Flow: ___ Clear ___ Cloudy ___ Suspended Solids ___ Other _____

Blockages: Yes ___ No ___ Sediment in Manhole: Yes ___ No ___ If Yes: Percent of Pipe Filled: _____ %

Floatables: None ___ Sewage ___ Oily Sheen ___ Foam ___ Other _____

Odor: None ___ Sewage ___ Oil ___ Soap ___ Other _____

Field Testing:

pH _____ Temp _____ Spec. Cond. _____ Surfactants: Yes ___ No ___ Ammonia: Yes ___ No ___

Contamination:

Found During Inspection Yes ___ Check one: ___ Observation ___ Positive Test Kit Result
 No ___ Sandbagged Placed No ___ Yes ___ Give Date _____

Sandbag Checked (Date): _____ Flow was ___ Captured ___ Not Captured:

Condition of Manhole:				Common Manholes:		
	Good	Fair	Poor	Comments	High Outlet: Blocked	Yes ___ No ___ NA ___
Grade: At ___ Above ___ Below ___					Lovejoy: Cover Plate in Place	Yes ___ No ___ NA ___
Pavement	_____	_____	_____	_____	Construction Material:	
Cover	_____	_____	_____	_____	Brick	Precast Other
Frame	_____	_____	_____	_____	_____	_____
Corbel	_____	_____	_____	_____	_____	_____
Walls	_____	_____	_____	_____	_____	_____
Floor	_____	_____	_____	_____	_____	_____

Comments: Manhole Correct as Mapped Yes ___ No ___

N†



Plan of Manhole

Figure 58: Boston Water and Sewer Commission Manhole Inspection Log (Source: Jewell, 2001)

Methods to isolate intermittent discharges in the storm drain network

Intermittent discharges are often challenging to trace in the storm drain network, although four techniques have been used with some success.

Sandbags

This technique involves placement of sandbags or similar barriers within strategic manholes in the storm drain network to form a temporary dam that collects any intermittent flows that may occur. Any flow collected behind the sandbag is then assessed using visual observations or by indicator sampling. Sandbags are lowered on a rope through the manhole to form a dam along the bottom of the storm drain, taking care not to fully block the pipe (in case it rains before the sandbag is retrieved). Sandbags are typically installed at junctions in the network to eliminate contributing branches from further consideration (Figure 59). If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge.

Sandbags are typically left in place for no more than 48 hours, and should only be installed when dry weather is forecast. Sandbags should not be left in place during a heavy rainstorm. They may cause a blockage in the storm drain, or, they may be washed downstream and lost. The biggest downside to sandbagging is that it requires at least two trips to each manhole.

Optical Brightener Monitoring (OBM) Traps

Optical brightener monitoring (OBM) traps, profiled in Chapter 12, can also be used to detect intermittent flows at manhole junctions. When these absorbent pads are anchored in the pipe to capture dry weather flows, they can be used to determine the presence of flow and/or detergents. These OBM traps are frequently installed by lowering them into an open-grate drop inlet or storm drain inlet, as shown in Figure 60. The pads are then retrieved after 48 hours and are observed under a fluorescent light (this method is most reliable for undiluted washwaters).

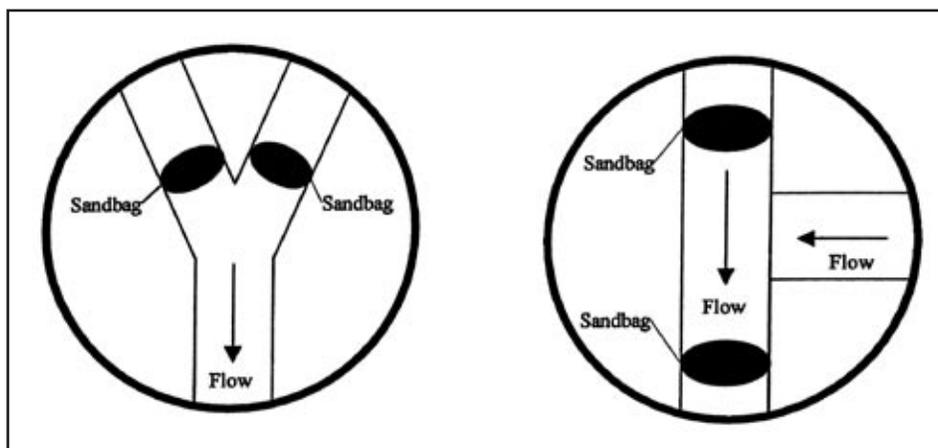


Figure 59: Example sandbag placement (Source: Jewell, 2001)



Figure 60: Optical Brightener Placement in the Storm Drain
(Source: Sargent and Castonguay, 1998)

Automatic Samplers

A few communities have installed automated samplers at strategic points within the storm drain network system that are triggered by small dry weather flows and collect water quality samples of intermittent discharges. Automated sampling can be extremely expensive, and is primarily used in very complex drainage areas that have severe intermittent discharge problems. Automated samplers can pinpoint the specific date and hours when discharges occur, and characterize its chemical composition, which can help crews fingerprint the generating source.

Observation of Deposits or Stains

Intermittent discharges often leave deposits or stains within the storm drain pipe or manhole after they have passed. Thus, crews should note whether any deposits or stains are present in the manhole, even if no dry weather flow is observed. In some cases, the origin of the discharge can be surmised by collecting indicator samples in the water ponded within the manhole sump. Stains and deposits, however, are not always a conclusive way to trace intermittent discharges in the storm drain network.

13.2 Drainage Area Investigations

The source of some illicit discharges can be determined through a survey or analysis of the drainage area of the problem outfall. The simplest approach is a rapid windshield survey of the drainage area to find the potential discharger or generating sites. A more sophisticated approach relies on an analysis of available GIS data and permit databases to identify industrial or other generating sites. In both cases, drainage area investigations are only effective if the discharge observed at an outfall has distinct or unique characteristics that allow crews to quickly ascertain the probable operation or business that is generating it. Often, discharges with a unique color, smell, or off-the-chart indicator sample reading may point to a specific industrial or commercial source. Drainage area investigations are not helpful in tracing sewage discharges, since they are often not always related to specific land uses or generating sites.

Rapid Windshield Survey

A rapid drive-by survey works well in small drainage areas, particularly if field crews are already familiar with its business operations. Field crews try to match the characteristics of the discharge to the most likely type of generating site, and then inspect all of the sites of the same type within the drainage area until the culprit is found. For example, if fuel is observed at an outfall, crews might quickly check every business operation in the catchment that stores or dispenses fuel. Another example is illustrated in Figure 61 where extremely dense algal growth was observed in a small stream during the winter. Field crews were aware of a fertilizer storage site in the drainage area, and a quick inspection identified it as the culprit.



Figure 61: Symptom (left): Discoloration of stream; Diagnosis: Extra hydroseed leftover from an upstream application (middle) was dumped into a storm drain by municipal officials (right).

A third example of the windshield survey approach is shown in Figure 62, where a very thick, sudsy and fragrant discharge was noted at a small outfall. The discharge appeared to consist of wash water, and the only commercial laundromat found upstream was confirmed to be the source. On-site testing may still be needed to identify the specific plumbing or connection generating the discharge.

Detailed Drainage Area Investigations

In larger or more complex drainage areas, GIS data can be analyzed to pinpoint the source of a discharge. If only general land use data exist, maps can at least highlight suspected industrial areas. If more detailed SIC code data are available digitally, the GIS can be used to pull up specific hotspot

operations or generating sites that could be potential dischargers. Some of the key discharge indicators that are associated with hotspots and specific industries are reviewed in Appendix K.

13.3 On-site Investigations

On-site investigations are used to pinpoint the exact source or connection producing a discharge within the storm drain network. The three basic approaches are dye, video and smoke testing. While each approach can determine the actual source of a discharge, each needs to be applied under the right conditions and test limitations (see Table 56). It should be noted that on-site investigations are not particularly effective in finding *indirect* discharges to the storm drain network.



Figure 62: The sudsy, fragrant discharge (left) indicates that the laundromat is the more likely culprit than the florist (right).

Table 56: Techniques to Locate the Discharge		
Technique	Best Applications	Limitations
Dye Testing	<ul style="list-style-type: none"> • Discharge limited to a very small drainage area (<10 properties is ideal) • Discharge probably caused by a connection from an individual property • Commercial or industrial land use 	<ul style="list-style-type: none"> • May be difficult to gain access to some properties
Video Testing	<ul style="list-style-type: none"> • Continuous discharges • Discharge limited to a single pipe segment • Communities who own equipment for other investigations 	<ul style="list-style-type: none"> • Relatively expensive equipment • Cannot capture non-flowing discharges • Often cannot capture discharges from pipes submerged in the storm drain
Smoke Testing	<ul style="list-style-type: none"> • Cross-connection with the sanitary sewer • Identifying other underground sources (e.g., leaking storage techniques) caused by damage to the storm drain 	<ul style="list-style-type: none"> • Poor notification to public can cause alarm • Cannot detect all illicit discharges

TIP

The Wayne County Department of the Environment provides excellent training materials on on-site investigations, as well as other illicit discharge techniques. More information about this training can be accessed from their website: http://www.wcdoe.org/Watershed/Programs___Srvcs_/IDEP/idep.htm.



Figure 63: Dye Testing Plumbing (NEIWPCC, 2003)

Dye Testing

Dye testing is an excellent indicator of illicit connections and is conducted by introducing non-toxic dye into toilets, sinks, shop drains and other plumbing fixtures (see Figure 63). The discovery of dye in the storm drain, rather than the sanitary sewer, conclusively determines that the illicit connection exists.

Before commencing dye tests, crews should review storm drain and sewer maps to identify lateral sewer connections and how they can be accessed. In addition, property owners must be notified to obtain entry permission. For industrial or commercial properties, crews should carry a letter to document their legal authority to gain

access to the property. If time permits, the letter can be sent in advance of the dye testing. For residential properties, communication can be more challenging. Unlike commercial properties, crews are not guaranteed access to homes, and should call ahead to ensure that the owner will be home on the day of testing.

Communication with other local agencies is also important since any dye released to the storm drain could be mistaken for a spill or pollution episode. To avoid a costly and embarrassing response to a false alarm,

crews should contact key spill response agencies using a “quick fax” that describes when and where dye testing is occurring (Tuomari and Thomson, 2002). In addition, crews should carry a list of phone numbers to call spill response agencies in the event dye is released to a stream.

At least two staff are needed to conduct dye tests – one to flush dye down the plumbing fixtures and one to look for dye in the downstream manhole(s). In some cases,

three staff may be preferred, with two staff entering the private residence or building for both safety and liability purposes.

The basic equipment to conduct dye tests is listed in Table 57 and is not highly specialized. Often, the key choice is the type of dye to use for testing. Several options are profiled in Table 58. In most cases, liquid dye is used, although solid dye tablets can also be placed in a mesh bag and lowered into the manhole on a rope (Figure 64). If a

Table 57: Key Field Equipment for Dye Testing <i>(Source: Wayne County, MI, 2000)</i>	
Maps, Documents	
<ul style="list-style-type: none"> • Sewer and storm drain maps (sufficient detail to locate manholes) • Site plan and building diagram • Letter describing the investigation • Identification (e.g., badge or ID card) • Educational materials (to supplement pollution prevention efforts) • List of agencies to contact if the dye discharges to a stream. • Name of contact at the facility 	
Equipment to Find and Lift the Manhole Safely (small manhole often in a lawn)	
<ul style="list-style-type: none"> • Probe • Metal detector • Crow bar • Safety equipment (hard hats, eye protection, gloves, safety vests, steel-toed boots, traffic control equipment, protective clothing, gas monitor) 	
Equipment for Actual Dye Testing and Communications	
<ul style="list-style-type: none"> • 2-way radio • Dye (liquid or “test strips”) • High powered lamps or flashlights • Water hoses • Camera 	



Figure 64: Dye in a mesh bag is placed into an upstream manhole (left); Dye observed at a downstream manhole traces the path of the storm drain (right)

longer pipe network is being tested, and dye is not expected to appear for several hours, charcoal packets can be used to detect the dye (GCHD, 2002). Charcoal packets can be secured and left in place for a week or two, and then analyzed for the presence of dye. Instructions for using charcoal packets in dye testing can be accessed at the following website: <http://bayinfo.tamug.tamu.edu/gbeppubs/ms4.pdf>.

The basic drill for dye tests consists of three simple steps. First, flush or wash dye down the drain, fixture or manhole. Second, pop open downgradient sanitary sewer manholes and check to see if any dye appears. If none is detected in the sewer manhole after an hour or so, check downgradient storm drain manholes or outfalls for the presence of dye. Although dye testing is fairly straightforward, some tips to make testing go more smoothly are offered in Table 59.

Table 58: Dye Testing Options

Product	Applications
Dye Tablets	<ul style="list-style-type: none"> • Compressed powder, useful for releasing dye over time • Less messy than powder form • Easy to handle, no mess, quick dissolve • Flow mapping and tracing in storm and sewer drains • Plumbing system tracing • Septic system analysis • Leak detection
Liquid Concentrate	<ul style="list-style-type: none"> • Very concentrated, disperses quickly • Works well in all volumes of flow • Recommended when metering of input is required • Flow mapping and tracing in storm and sewer drains • Plumbing system tracing • Septic system analysis • Leak detection
Dye Strips	<ul style="list-style-type: none"> • Similar to liquid but less messy
Powder	<ul style="list-style-type: none"> • Can be very messy and must dissolve in liquid to reach full potential • Recommended for very small applications or for very large applications where liquid is undesirable • Leak detection
Dye Wax Cakes	<ul style="list-style-type: none"> • Recommended for moderate-sized bodies of water • Flow mapping and tracing in storm and sewer drains
Dye Wax Donuts	<ul style="list-style-type: none"> • Recommended for large sized bodies of water (lakes, rivers, ponds) • Flow mapping and tracing in storm and sewer drains • Leak detection

Table 59: Tips for Successful Dye Testing
(Adapted from Tuomari and Thompson, 2002)

Dye Selection

- Green and liquid dyes are the easiest to see.
- Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
- Check the sanitary sewer before using dyes to get a “base color.” In some cases, (e.g., a print shop with a permitted discharge to the sanitary sewer), the sewage may have an existing color that would mask a dye.
- Choose two dye colors, and alternate between them when testing multiple fixtures.

Selecting Fixtures to Test

- Check the plumbing plan for the site to isolate fixtures that are separately connected.
- For industrial facilities, check most floor drains (these are often misdirected).
- For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
- Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
- If conducting dye investigations on multiple floors, start from the basement and work your way up.
- At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

Selecting a Sewer Manhole for Observations

- Pick the closest manhole possible to make observations (typically a sewer lateral).
- If this is not possible, choose the nearest downstream manhole.

Communications Between Crew Members

- The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
- The field person then calls back when dye is observed in the manhole.
- If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

Locating Missing Dye

- The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
- The building is actually hooked up to a septic system.
- The sewer line is clogged.
- There is a leak in the sewer line or lateral pipe.

Video Testing

Video testing works by guiding a mobile video camera through the storm drain pipe to locate the actual connection producing an illicit discharge. Video testing shows flows and leaks within the pipe that may indicate an illicit discharge, and can show cracks and other pipe damage that enable sewage or contaminated water to flow into the storm drain pipe.

Video testing is useful when access to properties is constrained, such as residential neighborhoods. Video testing can also be expensive, unless the community already owns and uses the equipment for sewer inspections. This technique will not detect all types of discharges, particularly when the illicit connection is not flowing at the time of the video survey.

Different types of video camera equipment are used, depending on the diameter and condition of the storm sewer being tested.

Field crews should review storm drain maps, and preferably visit the site before selecting the video equipment for the test. A field visit helps determine the camera size needed to fit into the pipe, and if the storm drain has standing water.

In addition to standard safety equipment required for all manhole inspections, video testing requires a Closed-Circuit Television (CCTV) and supporting items. Many commercially available camera systems are specifically adapted to televise storm sewers, ranging from large truck or van-mounted systems to much smaller portable cameras. Cameras can be self-propelled or towed. Some specifications to look for include:

- The camera should be capable of radial view for inspection of the top, bottom, and sides of the pipe and for looking up lateral connections.
- The camera should be color.
- Lighting should be supplied by a lamp on the camera that can light the entire periphery of the pipe.

When inspecting the storm sewer, the CCTV is oriented to keep the lens as close as possible to the center of the pipe. The camera can be self-propelled through the pipe using a tractor or crawler unit or it may be towed through on a skid unit (see Figures 65 and 66). If the storm drain



Figure 65: Camera being towed

has ponded water, the camera should be attached to a raft, which floats through the storm sewer from one manhole to the next. To see details of the sewer, the camera and lights should be able to swivel both horizontally and vertically. A video record of the inspection should be made for future reference and repairs (see Figure 67).

Smoke Testing

Smoke testing is another “bottom up” approach to isolate illicit discharges. It works by introducing smoke into the storm drain system and observing where the smoke surfaces. The use of smoke testing to detect illicit discharges is a relatively new application, although many communities have used it to check for infiltration and inflow into their sanitary sewer network. Smoke testing can find improper



Figure 66: Tractor-mounted camera



Figure 67: Review of an inspection video

connections, or damage to the storm drain system (Figure 68). This technique works best when the discharge is confined to the upper reaches of the storm drain network, where pipe diameters are too small for video testing and gaining access to multiple properties renders dye testing infeasible.

Notifying the public about the date and purpose of smoke testing before starting is critical. The smoke used is non-toxic, but can cause respiratory irritation, which can be a problem for some residents. Residents should be notified at least two weeks prior to testing, and should be provided the following information (Hurco Technologies, Inc., 2003):

- Date testing will occur
- Reason for smoke testing
- Precautions they can take to prevent smoke from entering their homes or businesses
- What they need to do if smoke enters their home or business, and any health concerns associated with the smoke
- A number of residents can call to relay any particular health concerns (e.g., chronic respiratory problems)

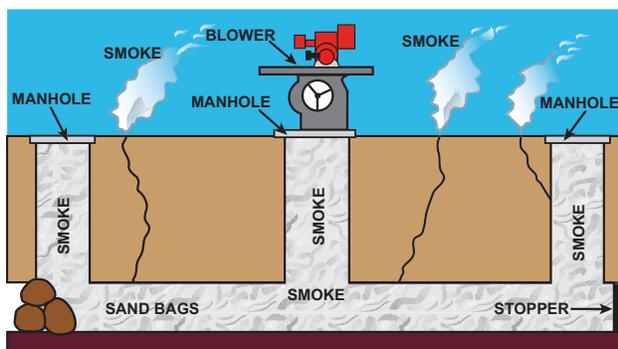


Figure 68: Smoke Testing System Schematic

Program managers should also notify local media to get the word out if extensive smoke testing is planned (e.g., television, newspaper, and radio). On the actual day of testing, local fire, police departments and 911 call centers should be notified to handle any calls from the public (Hurco Technologies, Inc., 2003).

The basic equipment needed for smoke testing includes manhole safety equipment, a smoke source, smoke blower, and sewer plugs. Two smoke sources can be used for smoke testing. The first is a smoke “bomb,” or “candle” that burns at a controlled rate and releases very white smoke visible at relatively low concentrations (Figure 69). Smoke bombs are suspended beneath a blower in a manhole. Candles are available in 30 second to three minute sizes. Once opened, smoke bombs should be kept in a dry location and should be used within one year.

The second smoke source is liquid smoke, which is a petroleum-based product that is injected into the hot exhaust of a blower where it is heated and vaporized (Figure 70). The length of smoke production can vary depending on the length of the pipe being



Figure 69: Smoke Candles



Figure 70: Smoke blower

tested. In general, liquid smoke is not as consistently visible and does not travel as far as smoke from bombs (USA Blue Book).

Smoke blowers provide a high volume of air that forces smoke through the storm drain pipe. Two types of blowers are commonly used: “squirrel cage” blowers and direct-drive propeller blowers. Squirrel cage blowers are large and may weigh more than 100 pounds, but allow the operator to generate more controlled smoke output. Direct-drive propeller blowers are considerably lighter and more compact, which allows for easier transport and positioning.

Three basic steps are involved in smoke testing. First, the storm drain is sealed off by plugging storm drain inlets. Next, the smoke is released and forced by the blower through the storm drain system. Lastly, the crew looks for any escape of smoke above-ground to find potential leaks.

One of three methods can be used to seal off the storm drain. Sandbags can be lowered into place with a rope from the street surface. Alternatively, beach balls that have a diameter slightly larger than the drain can be inserted into the pipe. The beach ball is then placed in a mesh bag with a

rope attached to it so it can be secured and retrieved. If the beach ball gets stuck in the pipe, it can simply be punctured, deflated and removed. Finally, expandable plugs are available, and may be inserted from the ground surface.

Blowers should be set up next to the open manhole after the smoke is started. Only one manhole is tested at a time. If smoke candles are used, crews simply light the candle, place it in a bucket, and lower it in the manhole. The crew then watches to see where smoke escapes from the pipe. The two most common situations that indicate an illicit discharge are when smoke is seen rising from internal plumbing fixtures (typically reported by residents) or from sewer vents. Sewer vents extend upward from the sewer lateral to release gas buildup, and are not supposed to be connected to the storm drain system.

13.4 Septic System Investigations

The techniques for tracing illicit discharges are different in rural or low-density residential watersheds. Often, these watersheds lack sanitary sewer service and storm water is conveyed through ditches or swales, rather than enclosed pipes. Consequently, many illicit discharges enter the stream as indirect discharges, through surface breakouts of septic fields or through straight pipe discharges from bypassed septic systems.

The two broad techniques used to find individual septic systems—on-site investigations and infrared imagery—are described in this section.

On-Site Septic Investigations

Three kinds of on-site investigations can be performed at individual properties to determine if the septic system is failing, including homeowner survey, surface condition analysis and a detailed system inspection. The first two investigations are rapid and relatively simple assessments typically conducted in targeted watershed areas. Detailed system inspections are a much more thorough investigation of the functioning of the septic system that is conducted by a certified professional. Detailed system inspections may occur at time of sale of a property, or be triggered by poor scores on the rapid homeowner survey or surface condition analysis.

Homeowner Survey

The homeowner survey consists of a brief interview with the property owner to determine the potential for current or future failure of the septic system, and is often done in conjunction with a surface condition analysis.

Table 60 highlights some common questions to ask in the survey, which inquire about resident behaviors, system performance and maintenance activity.

Surface Condition Analysis

The surface condition analysis is a rapid site assessment where field crews look for obvious indicators that point to current or potential production of illicit discharges by the septic system (Figure 71). Some of the key surface conditions to analyze have been described by Andrews *et al.*, (1997) and are described below:

- Foul odors in the yard
- Wet, spongy ground; lush plant growth; or burnt grass near the drain field
- Algal blooms or excessive weed growth in adjacent ditches, ponds and streams
- Shrubs or trees with root damage within 10 feet of the system
- Cars, boats, or other heavy objects located over the field that could crush lateral pipes
- Storm water flowing over the drain field
- Cave-ins or exposed system components
- Visible liquid on the surface of the drain field (e.g., surface breakouts)
- Obvious system bypasses (e.g., straight pipe discharges)

Table 60: Septic System Homeowner Survey Questions

(Adapted from Andrews *et al.*, 1997 and Holmes Inspection Services)

- How many people live in the house?¹
- What is the septic tank capacity?²
- Do drains in the house empty slowly or not at all?
- When was the last time the system was inspected or maintained?
- Does sewage back up into the house through drain lines?
- Are there any wet, smelly spots in the yard?
- Is the septic tank effluent piped so it drains to a road ditch, a storm sewer, a stream, or is it connected to a farm drain tile?

¹ Water usage ranges from 50 to 100 gallons per day per person. This information can be used to estimate the wastewater load from the house (Andrews *et. al.*, 1997).

² The septic tank should be large enough to hold two days' worth of wastewater (Andrews *et. al.*, 1997).

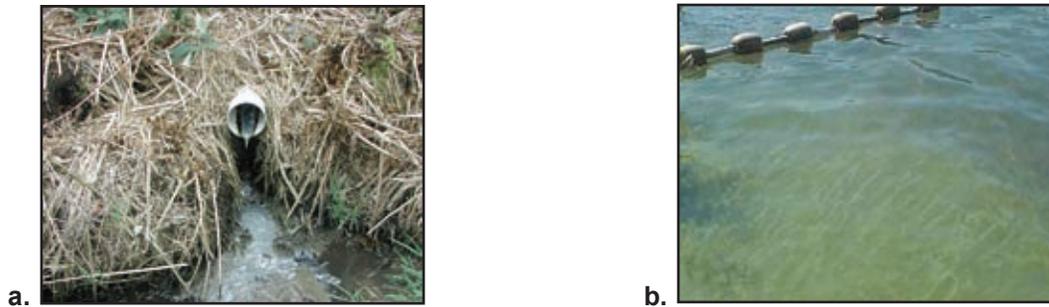


Figure 71: (a) Straight pipe discharge to nearby stream. (b) Algal bloom in a nearby pond.
(Sources: a- Snohomish County, WA, b- King County, WA)

Detailed System Inspection

The detailed system inspection is a much more thorough inspection of the performance and function of the septic system, and must be completed by a certified professional. The inspector certifies the structural integrity of all components of the system, and checks the depth of solids in the septic tank to determine if the system needs to be pumped out. The inspector also sketches the system, and estimates distance to groundwater, surface water, and drinking water sources. An example septic system inspection form from Massachusetts can be found at <http://www.state.ma.us/dep/brp/wm/soilsys.htm>.

Although not always incorporated into the inspection, dye testing can sometimes point to leaks from broken pipes, or direct discharges through straight pipes that might be missed during routine inspection. Dye can be introduced into plumbing fixtures in the home, and flushed with sufficient running water. The inspector then watches the septic field, nearby ditches, watercourses and manholes for any signs of the dye. The

dye may take several hours to appear, so crews may want to place charcoal packets in adjacent waters to capture dye until they can return later to retrieve them.

Infrared Imagery

Infrared imagery is a special type of photography with gray or color scales that represent differences in temperature and emissivity of objects in the image (www.stocktoninfrared.com), and can be used to locate sewage discharges. Several different infrared imagery techniques can be used to identify illicit discharges. The following discussion highlights two of these: aerial infrared thermography¹³ and color infrared aerial photography.

Infrared Thermography

Infrared thermography is increasingly being used to detect illicit discharges and failing septic systems. The technique uses the temperature difference of sewage as a marker to locate these illicit discharges. Figure 72 illustrates the thermal difference

¹³ Infrared thermography is also being used by communities such as Mecklenburg County and the City of Charlotte in NC to detect illicit discharges at outfalls.

between an outfall discharge (with a higher temperature) and a stream.

The equipment needed to conduct aerial infrared thermography includes an aircraft (plane or helicopter); a high-resolution, large format, infrared camera with appropriate mount; a GPS unit; and digital recording equipment. If a plane is used, a higher resolution camera is required since it must operate at higher altitudes. Pilots should be experienced since flights take place at night, slowly, and at a low altitude. The camera may be handheld, but a mounted camera will provide significantly clearer results for a larger area. The GPS can be combined with a mobile mapping program and a video encoder-decoder that encodes and displays the coordinates, date, and time (Stockton, 2000). The infrared data are analyzed after the flight by trained analysts to locate suspected discharges, and field crews then inspect the ground-truthed sites to confirm the presence of a failing septic system.

Late fall, winter, and early spring are typically the best times of year to conduct these investigations in most regions of the



Figure 72: Aerial thermography showing sewage leak

country. This allows for a bigger difference between receiving water and discharge temperatures, and interference from vegetation is minimized (Stockton, 2004b). In addition, flights should take place at night to minimize reflected and direct daylight solar radiation that may adversely affect the imagery (Stockton, 2004b).

Color Infrared Aerial Photography

Color infrared aerial photography looks for changes in plant growth, differences in soil moisture content, and the presence of standing water on the ground to primarily identify failing septic systems (Figure 73).

The Tennessee Valley Authority (TVA) uses color infrared aerial photography to detect failing septic systems in reservoir watersheds. Local health departments conduct follow-up ground-truthing surveys to determine if a system is actually failing (Sagona, 1986). Similar to thermography, it is recommended that flights take place at night, during leaf-off conditions, or when the water table is at a seasonal high (which is when most failures typically occur (U.S. EPA, 1999).

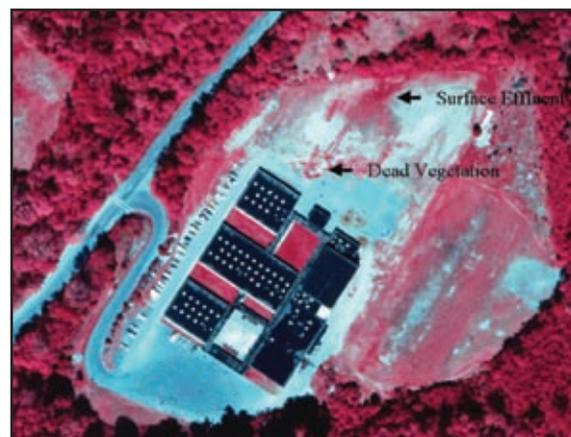


Figure 73: Dead vegetation and surface effluent are evidence of a septic system surface failure.

(Source: U.S. EPA, 1999)

13.5 The Cost to Trace Illicit Discharge Sources

Tracing illicit discharges to their source can be an elusive and complex process, and precise staffing and budget data are difficult to estimate. Experience of Phase I NPDES communities that have done these investigations in the past can shed some light on cost estimates. Some details on unit costs for common illicit discharge investigations are provided below.

Costs for Dye, Video, and Smoke Testing

The cost of smoke, dye, and video testing can be substantial and staff intensive, and

often depend on investigation specific factors, such as the complexity of the drainage network, density and age of buildings, and complexity of land use. Wayne County, MI, has estimated the cost of dye testing at \$900 per facility. Video testing costs range from \$1.50 to \$2.00 per foot, although this increases by \$1.00 per foot if pipe cleaning is needed prior to testing.

Table 61 summarizes the costs of start-up equipment for basic manhole entry and inspection, which is needed regardless of which type of test is performed. Tables 62 through 64 provide specific equipment costs for dye, video and smoke testing, respectively.

Table 61: Common Field Equipment Needed for Dye, Video, and Smoke Testing	
Item	Cost
1 Digital Camera	\$200
Clipboards, Pens, Batteries	\$25
1 Field vehicle	\$15,000 - \$35,000
1 First aid kit	\$30
1 Spotlight	\$40
1 Gas monitor and probe	\$900 - \$2,100
1 Hand-held GPS Unit	\$150
2 Two-way radios	\$250 - \$750
1 Manhole hook	\$80 - \$130
1 Mirror	\$70 - \$130
2 Reflective safety vests	\$40
Rubber/latex gloves (box of 100)	\$25
1 Can of Spray Paint	\$5
4 Traffic Cones	\$50

Table 62: Equipment Costs for Dye Testing

Product	Water Volume	Cost
Dye Strips	1 strip/500 gallons	\$75 – \$94 per 100 strips
Dye Tablets	0 – 50,000 gallons	\$40 per 200 tablets
Liquid Concentrate (Rhodamine WT)	0 – 50,000 gallons	\$80 – \$90 per gallon \$15 – \$20 per pint
Powder	50,000 + gallons	\$77 per lb
Dye Wax Cakes	20,000 – 50,000 gallons	\$12 per one 1.25 ounce cake
Dye Wax Donuts	50,000 + gallons	\$104 – \$132 per 42 oz. donut
<i>Price Sources:</i> Aquatic Eco-Systems http://www.aquaticceco.com/ Cole Parmer http://www.coleparmer.com USA Blue Book http://www.usabluebook.com		

Table 63: Equipment Costs for Video Testing

Equipment	Cost
GEN-EYE 2™ B&W Sewer Camera with VCR & 200' Push Cable	\$5,800
100' Push Rod and Reel Camera for 2" – 10" Pipes	\$5,300
200' Push Rod and Reel Camera for 8" – 24" Pipes	\$5,800
Custom Saturn III Inspection System 500' cable for 6-16" Lines	\$32,000 (\$33,000 with 1000 foot cable)
OUTPOST	
<ul style="list-style-type: none"> • Box with build-out • Generator • Washdown system 	\$6,000 \$2,000 \$1,000
Video Inspection Trailer	
<ul style="list-style-type: none"> • 7'x10' trailer & build-out • Hardware and software package • Incidentals 	\$18,500 \$15,000 \$5,000
Sprinter Chassis Inspection Vehicle	
<ul style="list-style-type: none"> • Van (with build-out for inspecting 6" – 24" pipes) • Crawler (needed to inspect pipes >24") • Software upgrade (optional but helpful for extensive pipe systems) 	\$130,000 \$18,000 \$8,000
<i>Sources: USA Blue Book and Envirotech</i>	

Table 64: Equipment Costs for Smoke Testing

Equipment	Cost
Smoke Blower	\$1,000 to \$2,000 each
Liquid Smoke	\$38 to \$45 per gallon
Smoke Candles, 30 second (4,000 cubic feet)	\$27.50 per dozen
Smoke Candles, 60 Second (8,000 cubic feet)	\$30.50 per dozen
Smoke Candles, 3 Minute (40,000 cubic feet)	\$60.00 per dozen
<i>Sources: Hurco Tech, 2003 and Cherne Industries, 2003</i>	

Costs for Septic System Investigations

Most septic system investigations are relatively low cost, but factors such as private property access, notification, and the total number of sites investigated can increase costs. Unit costs for the three major septic system investigations are described below.

Homeowner Survey and Surface Condition Analysis

Both the homeowner survey and the surface condition analysis are relatively low cost investigation techniques. Assuming that a staff person can investigate one home per hour, the average cost per inspection is approximately \$25. A substantial cost savings can be realized by using interns or volunteers to conduct these simple investigations.

Detailed System Inspection

Septic system inspections are more expensive, but a typical unit cost is about \$250, and may also include an additional cost of pumping the system, at roughly \$150, if pumping is required to complete the inspection (Wayne County, 2003). This cost is typically charged to the homeowner as part of a home inspection.

Aerial Infrared Thermography

The equipment needed to conduct aerial infrared thermography is expensive; cameras alone may range from \$250,000 to \$500,000 (Stockton, 2004a). However, private contractors provide this service. In general, the cost to contract an aerial infrared thermography investigation depends on the length of the flight (flights typically follow streams or rivers); how difficult it will be to fly the route; the number of heat anomalies expected to be encountered; the expected post-flight processing time (typically, four to five hours of analysis for every hour flown); and the distance of the site from the plane's "home" (Stockton, 2004a). The cost range is typically \$150 to \$400 per mile of stream or river flown, which includes the flight and post-flight analyses (Stockton, 2004a).

As an alternative, local police departments may already own an infrared imaging system that may be used. For instance, the Arkansas Department of Health used a state police helicopter with a Forward Looking Infrared (FLIR) imaging system, GPS, video equipment, and maps (Eddy, 2000). The disadvantage to this is that the equipment may not be available at optimal times to conduct the investigation. In addition, infrared imaging equipment used by police departments may not be sensitive enough to detect the narrow range of temperature difference (only a few degrees) often expected for sewage flows (Stockton, 2004a).

Chapter 14: Techniques to Fix Discharges

Quick and efficient correction of illicit discharges begins with having well defined legal authority and responsibilities coupled with strong enforcement and follow-up measures. Chapter 4 discussed important considerations with respect to legal authority and responsibility and Appendix B contains a model illicit discharge ordinance that provides language on violations, enforcement and penalties.

Most illicit discharge corrective actions involve some form of infrastructure modification or repair. These structural repairs are used to eliminate a wide variety of **direct discharges** such as sewage cross-connections, straight pipes, industrial cross-connections, and commercial cross-connections. Fixes range from simple plumbing projects to excavation and replacement of sewer lines. In some cases, structural repairs are necessary when **indirect** discharges, such as sewage from a sewer break or pump station failure enter the MS4 through an inlet, or flows directly into receiving waters. Most **transitory** discharges are corrected simply with spill containment and clean-up procedures. Section 8.3 previously discussed an overview of the correction process. The following section discusses more specific correction considerations.

14.1 Implementation Considerations

Once the source of an illicit discharge has been identified, steps should be taken to fix or eliminate the discharge. The following four questions should be answered for each

individual illicit discharge to determine how to proceed:

- Who is responsible?
- What methods will be used to fix it?
- How long will it take?
- How will removal be confirmed?

The answer to each of these questions depends on the source of the discharge. Illicit discharges generally originate from one of the following sources:

- *An internal plumbing connection* (e.g., the discharge from a washing machine is directed to the building's storm lateral; the floor drain in a garage is connected to the building's storm lateral)
- *A service lateral cross-connection* (e.g., the sanitary lateral from a building is connected to the MS4)
- *An infrastructure failure within the sanitary sewer or MS4* (e.g., a collapsed sanitary line is discharging into the MS4)
- *An indirect transitory discharge resulting from leaks, spills, or overflows.*

Financial responsibility for source removal will typically fall on property owners, MS4 operators, or some combination of the two.

Who's responsible for fixing the problem?

Ultimate responsibility for removing the source of a discharge is generally that of either the property owner or the municipality/utility (e.g., primary owner/operator of the MS4).

Internal Plumbing Connection

The responsibility for correcting an internal plumbing connection is generally the responsibility of the building owner. Communities may wish to develop a list of certified contractors that property owners can hire for corrections.

Service Lateral

As with internal plumbing connections, the responsibility for correcting a problem within a service lateral is typically that of the property owner being served by the lateral. However, the cost of correcting a service lateral problem can be significantly higher than that of fixing an internal plumbing problem, so communities may want to consider alternative remedial approaches than those for internal plumbing corrections. For example, communities can have on-call contractors fix lateral connections allowing the problem to be fixed as soon as it is discovered. The community can then:

- 1) pay for correction costs through the capital budget, or state or federal funding options, or
- 2) share the cost with the owner, or
- 3) pass on the full cost to the property owner.

Infrastructure Failure Within the Sanitary Sewer or MS4

Illicit discharges related to some sort of infrastructure failure within the sanitary sewer or MS4 should be corrected by the jurisdiction, utility, or agency responsible for maintenance of the sewers and drains.

Transitory Discharge

Repair of transitory discharge sources will usually be the responsibility of the property owner where the discharge originates. Ordinances should clearly stipulate the time frame in which these discharges should be repaired.

What methods will be used to fix the problem?

The methods used to eliminate discharges will vary depending on the type of problem and the location of the problem. Internal plumbing corrections can often be performed using standard plumbing supplies for relatively little cost. For correction locations that occur outside of the building, such as service laterals or infrastructure in the right of way, costs tend to be significantly more due to specialized equipment needs. Certified contractors are recommended for these types of repairs. Table 65 provides a summary of a range of methods for fixing these more significant problems along with estimated costs. The last six techniques described in Table 68 are used for sanitary sewer line repair and rehabilitation. These activities are typically used when there is evidence of significant seepage from the sanitary system to the storm drain system.

How long should it take?

The timeframe for eliminating a connection or discharge should depend on the type of connection or discharge and how difficult elimination will be. A discharge that poses a significant threat to human or environmental health should be discontinued and eliminated immediately. Clear guidance should be provided in the local ordinance on the timeframe for removing discharges and connections. Typically, discharges should be stopped within seven days of notification by the municipality, and illicit connections should be repaired within 30 days of notification.

How is the removal or correction confirmed?

Removal and correction of a discharge or connection should be confirmed both at the

source, to ensure that the correction has been made, and downstream, to ensure that it is the only local discharge present.

For discharges resulting from internal plumbing and lateral connections, dye testing can confirm the correction. Also, sandbagging should be done in the first accessible storm drain manhole downstream

of the correction to verify that this was the only discharge present.

The correction of discharges resulting from some sort of infrastructure failure in the sanitary sewer or MS4 can be verified by dye testing or televising the line in conjunction with sandbagging and sampling at an accessible downstream manhole.

Table 65: Methods to Eliminate Discharges

Technique	Application	Description	Estimated Cost
1. Service Lateral Disconnection, Reconnection	Lateral is connected to the wrong line	Lateral is disconnected and reconnected to appropriate line	\$2,500 ¹
2. Cleaning	Line is blocked or capacity diminished	Flushing (sending a high pressure water jet through the line); pigging (dragging a large rubber plug through the lines); or rodding	\$1/linear foot ²
3. Excavation and Replacement	Line is collapsed, severely blocked, significantly misaligned, or undersized	Existing pipe is removed, new pipe placed in same alignment; Existing pipe abandoned in place, replaced by new pipe in parallel alignment	For 14" line, \$50-\$100/linear foot (higher number is associated with repaving or deeper excavations, if necessary) ²
4. Manhole Repair	Decrease ponding; prevent flow of surface water into manhole; prevent groundwater infiltration	Raise frame and lid above grade; install lid inserts; grout, mortar or apply shotcrete inside the walls; install new precast manhole.	Vary widely, from \$250 to raise a frame and cover to ~ \$2,000 to replace manhole ²
5. Corrosion Control Coating	Improve resistance to corrosion	Spray- or brush-on coating applied to interior of pipe.	< \$10/linear foot ²
6. Grouting	Seal leaking joints and small cracks	Seals leaking joints and small cracks.	For a 12" line, ~ \$36-\$54/linear foot ²
7. Pipe Bursting	Line is collapsed, severely blocked, or undersized	Existing pipe used as guide for inserting expansion head; expansion head increases area available for new pipe by pushing existing pipe out radially until it cracks; bursting device pulls new pipeline behind it	For 8" pipe, \$40-\$80/linear foot ⁴
8. Slip Lining	Pipe has numerous cracks, leaking joints, but is continuous and not misaligned	Pulling of a new pipe through the old one.	For 12" pipe, \$50-\$75 /linear foot ²
9. Fold and Formed Pipe	Pipe has numerous cracks, leaking joints	Similar to sliplining but is easier to install, uses existing manholes for insertion; a folded thermoplastic pipe is pulled into place and rounded to conform to internal diameter of existing pipe	For 8-12" pipe, \$60-\$78/linear foot ³

Table 65: Methods to Eliminate Discharges			
Technique	Application	Description	Estimated Cost
10. Inversion Lining	Pipe has numerous cracks, leaking joints; can be used where there are misalignments	Similar to sliplining but is easier to install, uses existing manholes for insertion; a soft resin impregnated felt tube is inserted into the pipe, inverted by filling it with air or water at one end, and cured in place.	\$75-\$125/linear foot ²
<p>1 CWP (2002) 2 1991 costs from Brown (1995) 3 U.S. EPA (1991) 4 U.S. EPA (1999b)</p>			

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TECHNICAL APPENDICES

by the
Center for
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and
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October 2004

TECHNICAL APPENDICES
ILLICIT DISCHARGE DETECTION AND ELIMINATION: A
GUIDANCE MANUAL FOR PROGRAM DEVELOPMENT
AND TECHNICAL ASSESSMENTS

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APPENDIX A

**GENERATING SITES, STORM WATER
REGULATORY STATUS, AND DISCHARGE POTENTIAL**

The information presented in this Appendix refers to the Standard Industrial Classification (SIC) system. This system has historically been used to classify industries and other businesses for census, tax, permit and other purposes. It should be noted that, more recently, federal agencies, including EPA, have adopted the North American Industry Classification System (NAICS, pronounced “Nakes”) as the industry classification system. For more information on the NAICS and how it correlates with SIC, visit <http://www.census.gov/epcd/www/naics.html>.

Overview

Identification of land uses that may impact water quality in local streams can be a difficult and time-consuming task. Research suggests that program managers might wish to preferentially investigate certain land uses when looking for the sources of possible pollutant loads. These land uses are all considered to be generating sites where routine operations can produce higher levels of storm water pollutants, and/or present a higher potential risk for spills, leaks or illicit discharges. There are two basic types of generating sites: *regulated hotspots* that are known sources of pollution and are subject to federal or state regulations, and *unregulated hotspots* which are operations suspected to be potential pollution sources, but which are not currently regulated.

Identifying Potential Generating Sites

The number and type of generating sites present in a subwatershed may vary greatly, and currently there is no public database available to identify all the regulated sites in a subwatershed. Instead, multiple databases need to be queried to identify generating sites that may be targets for source control or illicit discharge investigations. A three-phase approach is useful for gathering as

much information as possible on generating sites within a subwatershed that may qualify for more intensive scrutiny.

Phase 1. Consult publicly available databases

The federal government has a number of databases that may help identify locations for investigation. The Environmental Protection Agency (EPA) operates two such databases. The first is the Enforcement and Compliance History Online (ECHO) database. With this system, facility compliance history can be queried and facilities can be found based on geographic location (county level), or zip code (<http://www.epa.gov/echo/index.html>). The other database is Envirofacts (<http://www.epa.gov/enviro/>). This website provides access to multiple EPA databases to provide information about environmental activities (including Resource Conservation and Recovery Act [RCRA] and Toxic Release Inventory [TRI] facilities) that may affect air, water, and land anywhere in the United States. The website also provides access to Enviromapper, which will display the location of regulated facilities. There are also commercial databases that can provide information on regulated industries based on manufacturing or industrial SIC codes. These databases are not free, and have limitations since they are designed primarily for marketing.

Phase 2. Consult State and Local Agencies

Most states have NPDES permit programs, and track permit application to some extent. You can consult state or local regulatory agencies to obtain lists of industries that have filed NOIs (Notices of Intent) to obtain storm water permits, as well as those that have filed under TRI requirements. Other agencies that may have information on local generating sites include fire departments (for

hazardous waste), and sanitation or wastewater treatment agencies.

Phase 3. Permit Review

The final source for information is through a review of local permits. Most permit databases have SIC codes as one of the fields. These codes can be matched against the SIC codes in Table A.1 that list common generating sites under major land use headings. If a local permit database does not exist, it may be worthwhile to simply get the local phone book and do a quick look for businesses that are similar to those listed in Table A.1.

Compiling the findings from the various databases will provide an initial list of potential generating sites for future investigation. However, research has found that most of these databases can miss many of the industries that are subject to regulation (Duke *et al.*, 1999; Duke and Shaver, 1999), and further identification may be necessary. Field investigations using techniques such as the Unified Subwatershed and Site Reconnaissance (Wright *et al.*, 2004) can assist in identifying many of these generating sites that should likely be regulated by communities.

Reference Tables

This appendix is designed to assist in identifying the land uses and associated generating sites in a subwatershed where routine activities may result in pollution being discharged to the storm drain system. There are two tables provided, each of which is described below.

Table A.1 presents a listing of potential generating sites under common land uses where illicit discharges can occur based on

regular activities or practices. Column one describes the general industry type. Column two lists their associated SIC codes, if known. Column three identifies whether an industry type is subject to NPDES industrial storm water permit requirements (designated by “X”). Facilities where only certain activities or facilities at the site are subject to regulation are noted (this pertains mostly to the transport-related industries). In addition, for many “light” industrial facilities, storm water permits are required only if material handling equipment or activities, raw materials, immediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water. Industries where this applies are noted with an “***”. If only specific SIC codes within a major group qualify for this exception they are noted in parentheses. Municipal facilities that are subject to NPDES MS4 permit requirements are designated by “MS4.” Column four identifies those businesses that can be considered an unregulated storm water hotspot (also designated by “X”). Column five looks at the illicit discharge potential of each of the businesses listed. The potential for a business to produce an illicit discharge is rated as either high (H) medium (M) or Low (L) based on the likelihood that it has a direct connection to the storm drain system (direct) or that it can produce a transitory discharge (indirect).

Table A.2 is a list of the SIC Codes that are regulated by the Industrial Multi Sector General Permit (MSGP). The list includes the four-digit SIC code level along with the official description. This table is provided for those who wish to know the full description of each SIC code that is regulated by NPDES industrial storm water permits.

Table A.1: Common Generating Sites and their Pollution Potential					
Land Use Generating Site Description	Associated SIC Code(s)	Regulated Storm Water Hotspot	Unregulated Storm Water Hotspot	Illicit Discharge Potential*	
				Direct	Indirect
Commercial					
Animal Care Services	0742, 0752		X	L	L
Auto Repair	7532-7539, 7549		X	M	M
Automobile Parking	7521			L	M
Building Materials	5211-5251		X	L	L
Campgrounds/RV parks	7033		X	L	M
Car Dealers	5511-5599,		X	M	M
Car Washes	7542		X	L	L
Commercial Laundry/Dry Cleaning	7211-7219		X	L	L
Convenience Stores	5399		X	L	L
Food Stores and Wholesale Food and Beverage	5141-5149 5411-5499		X	L	M
Equipment Repair	7622-7699		X	L	L
Gasoline Stations	5541		X	M	M
Heavy Construction Equipment Rental and Leasing	7353		X	L	H
Building and Heavy Construction (For land disturbing activities)	1521-1542 1611-1629	X		L	H
Marinas	4493	X		L	M
Nurseries and garden centers	5261		X	L	M
Oil Change Shops	7549		X		M
Restaurants	5812,5813,7011		X	M	L
Swimming Pools	7997, 7999		X	L	L
Warehouses	4221-4226	X** (4221-4225)		L	L
Wholesalers of Chemical and Petroleum	5162- 5169,5172		X	L	L
Industrial					
Apparel and Other Fabrics	2311–2399 3131–3199	X**		2300 L 3100 H	L M
Auto Recyclers and Scrap Yards	5015, 5093	X		L	H
Beverages and Brewing	2082-2087	X**		L	L
Boat Building and Repair	3731,3732	X		L	H
Chemical Products	2812-2899	X** (2830, 2850)		2810 H 2820 H 2840 H 2860 M 2830 L 2850 L 2870 L 2890 L	2810 L 2820 L 2840 L 2860 L 2830 L 2850 L 2870 L 2890 L

Table A.1: Common Generating Sites and their Pollution Potential					
Land Use Generating Site Description	Associated SIC Code(s)	Regulated Storm Water Hotspot	Unregulated Storm Water Hotspot	Illicit Discharge Potential*	
				Direct	Indirect
Industrial (continued)					
Food Processing	2011–2141	X**		2010 H 2020 H 2030 H 2040 H 2050 L 2060 L 2070 M 2090 L 2110 M	2010 L 2020 L 2030 L 2040 L 2050 L 2060 L 2070 L 2090 L 2110 L
Garbage Truck Washout Activities	4212		X	L	H
Industrial or Commercial Machinery, Electronic Equipment	3511–3599 3612–3699	X**		L	L
Instruments; Photographic and Optical Goods, Watches and Clocks and other Miscellaneous Manufacturing	3812–3873 3933-3999	X**		L	L
Leather Tanners	3411	X		H	M
Metal Production, Plating and Engraving Operations	2514, 2522, 2542, 3312- 3399, 3411- 3499, 3590	X** (2514,2522, 2542, 3411- 3433, 3442- 3499, 3590)		H	L
Paper and Wood Products	2411-2499, 2511, 2512, 2517, 2519, 2521, 2541, 2611–2679	X** (2434, 2652– 2657, 2671– 2679)		2400 L 2500 L 2600 H	2400 H 2500 L 2600 H
Petroleum Storage and Refining	2911	X		2911 H	H
Printing	2711–2796	X**		L	L
Rubber and Plastics	3011-3089	X**		M	L
Stone, Glass, Clay, Cement, Concrete, and Gypsum Product	3211-3299	X** (3233)		L	L
Textile Mills	2211–2299	X**		H	L
Transportation Equipment	3711–3728, 3743-3799	X**		H	M
Institutional					
Cemeteries	6553		X	L	L
Churches	8661		X	L	L
Colleges and Universities	8221-8222		X	L	M
Corporate Office Parks			X	L	L
Hospitals	8062-8069 8071-8072		X	L	L
Private Golf Courses	7997		X	L	L
Private Schools	8211		X	L	L

Table A.1: Common Generating Sites and their Pollution Potential					
Land Use Generating Site Description	Associated SIC Code(s)	Regulated Storm Water Hotspot	Unregulated Storm Water Hotspot	Illicit Discharge Potential*	
				Direct	Indirect
Municipal					
Composting Facilities	2875	X		L	L
Public Golf Courses	7992		X	L	L
Landfills and Hazardous Waste Material Disposal	4953, HZ, LF	X		L	H
Local Streets		MS4	X	L	H
Maintenance Depots	4173	MS4		M	H
Municipal Fleet Washing	4100	MS4		L	M
Public Works Yards		MS4		M	H
Steam Electric Plants	SE	X		L	L
Treatment Works	TW	X		L	L
Transport Related (NPDES regulation is for the portion of the facility dedicated to vehicle maintenance shops, equipment-cleaning operations, and airport deicing operations).					
Airports	4581	X		L	M
Streets and Highways Construction	1611, 1622	X		L	H
Ports	4449, 4499	X		L	H
Railroads	4011, 4013	X		L	H
Rental Car Lots	7513-7519	X		L	M
US Postal Service	4311	X		L	M
Trucking Companies and Distribution Centers	4212-4215, 4231	X		L	M
Petroleum Bulk Stations or Terminals	5171	X		L	H
*Adapted from Pitt (2001) ** Generating sites where storm water permits are required only if material handling equipment or activities, raw materials, immediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.					

Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity	
Sector A. Timber Products	
2411	Log Storage and Handling
2421	General Sawmills and Planning Mills
2426	Hardwood Dimension and Flooring Mills
2429	Special Product Sawmills, Not Elsewhere Classified
2431–2439	Millwork, Veneer, Plywood, and Structural Wood (except 2434)
2448, 2449	Wood Containers
2451, 2452	Wood Buildings and Mobile Homes
2491	Wood Preserving
2493	Reconstituted Wood Products
2499	Wood Products, Not Elsewhere Classified
Sector B. Paper and Allied Products Manufacturing	
2611	Pulp Mills
2621	Paper Mills
2631	Paperboard Mills
2652–2657	Paperboard Containers and Boxes
2671–2679	Converted Paper and Paperboard Products, Except Containers and Boxes
Sector C. Chemical and Allied Products Manufacturing	
2812–2819	Industrial Inorganic Chemicals
2821–2824	Plastics Materials and Synthetic Resins, Synthetic Rubber, Cellulosic and Other Manmade Fibers Except Glass
2833–2836	Medicinal chemicals and botanical products; pharmaceutical preparations; invitro and invivo diagnostic substances; biological products, except diagnostic substances
2841–2844	Soaps, Detergents, Cleaning Preparations; Perfumes, Cosmetics, Other Toilet Preparations
2851	Paints, Varnishes, Lacquers, Enamels, and Allied Products
2861–2869	Paints, Varnishes, Lacquers, Enamels, and Allied Products
2873–2879	Industrial Organic Chemicals
2891–2899	Agricultural Chemicals, Including Facilities that Make Fertilizer Solely from Leather Scraps and Leather Dust
3952 (limited to list)	Miscellaneous Chemical Products Inks and Paints, Including China Painting Enamels, India Ink, Drawing Ink, Platinum Paints for Burnt Wood or Leather Work, Paints for China Painting, Artist's Paints and Watercolors
Sector D. Asphalt Paving and Roofing Materials Manufacturers and Lubricant Manufacturers	
2951, 2952	Asphalt Paving and Roofing Materials
2992, 2999	Miscellaneous Products of Petroleum and Coal
Sector E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing	
3211	Flat Glass
3221, 3229	Glass and Glassware, Pressed or Blown
3231	Glass Products Made of Purchased Glass
3241	Hydraulic Cement
3251–3259	Structural Clay Products
3261–3269	Pottery and Related Products
3271–3275	Concrete, Gypsum and Plaster Products
3281	Cut Stone and Stone Products
3291–3292	Abrasive and Asbestos Products
3295	Minerals and Earth's, Ground, or Otherwise Treated
3296	Mineral Wool
3297	Non-Clay Refractories
3299	Nonmetallic Mineral Products, Not Elsewhere Classified

Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity	
Sector F. Primary Metals	
3312–3317	Steel Works, Blast Furnaces, and Rolling and Finishing Mills
3321–3325	Iron and Steel Foundries
3331–3339	Primary Smelting and Refining of Nonferrous Metals
3341	Secondary Smelting and Refining of Nonferrous Metals
3351–3357	Rolling, Drawing, and Extruding of Nonferrous Metals
3363–3369	Nonferrous Foundries (Castings)
3398, 3399	Miscellaneous Primary Metal Products
Sector G. Metal Mining (Ore Mining and Dressing)	
1011	Iron Ores
1021	Copper Ores
1031	Lead and Zinc Ores
1041, 1044	Gold and Silver Ores
1061	Ferroalloy Ores, Except Vanadium
1081	Metal Mining Services
1094, 1099	Miscellaneous Metal Ores
Sector H. Coal Mines and Coal Mining-Related Facilities	
1221–1241	Coal Mines and Coal Mining-Related Facilities Sector
Sector I. Oil and Gas Extraction and Refining	
1311	Crude Petroleum and Natural Gas
1321	Natural Gas Liquids
1381–1389	Oil and Gas Field Services
2911	Petroleum refining
Sector J. Mineral Mining and Dressing	
1411	Dimension Stone
1422–1429	Crushed and Broken Stone, Including Rip Rap
1481	Nonmetallic Minerals, Except Fuels
1442, 1446	Sand and Gravel
1455, 1459	Clay, Ceramic, and Refractory Materials
1474–1479	Chemical and Fertilizer Mineral Mining
1499	Miscellaneous Nonmetallic Minerals, Except Fuels
Sector K. Hazardous Waste Treatment Storage or Disposal Facilities	
HZ	Hazardous Waste Treatment, Storage or Disposal
Sector L. Landfills and Land Application Sites	
LF	Landfills, Land Application Sites and Open Dumps
Sector M. Automobile Salvage Yards	
5015	Automobile Salvage Yards
Sector N. Scrap Recycling Facilities	
5093	Scrap Recycling Facilities
Sector O. Steam Electric Generating Facilities	
SE	Steam Electric Generating Facilities
Sector P. Land Transportation	
4011, 4013	Railroad Transportation
4111–4173	Local and Highway Passenger Transportation
4212–4231	Motor Freight Transportation and Warehousing
4311	United States Postal Service
5171	Petroleum Bulk Stations and Terminals
Sector Q. Water Transportation	
4412–4499	Water Transportation
Sector R. Ship and Boat Building or Repairing Yards	
3731, 3732	Ship and Boat Building or Repairing Yards
Sector S. Air Transportation Facilities	
4512–4581	Air Transportation Facilities

Table A.2: SIC and Activity Codes for EPA's Multi-Sector General Permit for Industrial Activity	
Sector T. Treatment Works	
TW	Treatment Works
Sector U. Food and Kindred Products	
2011–2015	Meat Products
2021–2026	Dairy Products
2032	Canned, Frozen and Preserved Fruits, Vegetables and Food Specialties
2041–2048	Grain Mill Products
2051–2053	Bakery Products
2061–2068	Sugar and Confectionery Products
2074–2079	Fats and Oils
2082–2087	Beverages
2091–2099	Miscellaneous Food Preparations and Kindred Products
2111–2141	Tobacco Products
Sector V. Textile Mills, Apparel, and Other Fabric Product Manufacturing	
2211–2299	Textile Mill Products
2311–2399	Apparel and Other Finished Products Made From Fabrics and Similar Materials
3131–3199	Leather Products (except 3111)
Sector W. Furniture and Fixtures	
2511–2599	Furniture and Fixtures
2434	Wood Kitchen Cabinets
Sector X. Printing and Publishing	
2711–2796	Printing, Publishing and Allied Industries
Sector Y. Rubber, Miscellaneous Plastic Products, and Miscellaneous Manufacturing Industries	
3011	Tires and Inner Tubes
3021	Rubber and Plastics Footwear
3052, 3053	Gaskets, Packing, and Sealing Devices and Rubber and Plastics Hose and Belting
3061, 3069	Fabricated Rubber Products, Not Elsewhere Classified
3081–3089	Miscellaneous Plastics Products
3931	Musical Instruments
3942–3949	Dolls, Toys, Games and Sporting and Athletic Goods
3951–3955	Pens, Pencils, and Other Artists' Materials (except 3952)
3961, 3965	Costume Jewelry and Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal
3991–3999	Miscellaneous Manufacturing Industries
Sector Z. Leather Tanning and Finishing	
3111	Leather Tanning and Finishing
Sector AA. Fabricated Metal Products	
3411–3499	Fabricated Metal Products, Except Machinery and Transportation Equipment and Cutting, Engraving and Allied Services
3911–3915	Jewelry, Silverware, and Plated Ware
3479	Coating, Engraving, and Allied Services
Sector AB. Transportation Equipment, Industrial or Commercial Machinery	
3511–3599	Industrial and Commercial Machinery (except 3571–3579)
3711–3799	Transportation Equipment (except 3731, 3732)
Sector AC. Electronic, Electrical, Photographic and Optical Goods	
3612–3699	Electronic, Electrical Equipment and Components, Except Computer Equipment
3812–3873	Measuring, Analyzing and Controlling Instrument, Photographic/Optical Goods,
3571–3579	Watches/Clocks Computer and Office Equipment
Miscellaneous	
1521-1542	Building Construction General Contractors And Operative Builders
1611-1629	Heavy Construction Other Than Building Construction Contractors

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APPENDIX B

MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

Introduction to the Model Illicit Discharge and Connection Ordinance

The model ordinance provided in this Appendix is intended to be a tool for communities who are responsible for meeting the illicit discharge detection and correction requirements of the National Pollutant Discharge Elimination System (NPDES) regulations. This model ordinance is provided to assist communities in creating their own illicit discharge ordinances. In designing this model, an attempt was made to avoid creating too complex an ordinance, and instead to provide standard language and concepts that a good illicit discharge ordinance might contain. The language was borrowed from a number of ordinances.

Feel free to use and alter any and all portions of this document to meet the needs of the local community. Throughout the ordinance, there are sections in which the name of the agency to which regulatory power over illicit discharges has been given should be filled in to customize it. These sections are denoted by text placed in brackets – [authorized enforcement agency].

Italicized text with this symbol should be interpreted as comments, instructions, or information to assist local governments in tailoring the ordinance. This text would not appear in a final adopted ordinance. This ordinance should not be construed as an exhaustive listing of all the language needed for a local ordinance, but represents

a good base that communities can build upon and customize to be consistent with the staff resources available in their locality. It is recommended that this document be used in conjunction with other sources, such as existing ordinances created by other IDDE programs in the same geographic region and with similar objectives. In addition, several state agencies, councils of governments, and other regional groups have developed model ordinances. Two very comprehensive yet different examples of ordinances are:

- Model Storm Water Ordinance
Source: North Central Texas Council of Governments
(www.dfwstormwater.com/illicits)
- Model Illicit Discharge and Illegal Connection Ordinance
Source: Metropolitan North Georgia Water Planning District
(www.northgeorgiawater.com)

For those areas where septic systems are commonly used for wastewater treatment, language requiring inspection of these systems should also be added. The Washtenaw County (MI) *Regulation for the Inspection of Residential On-site Water and Sewage Disposal Systems at Time of Property Transfer* is an example of an ordinance that specifies requirements for inspection and maintenance of septic systems.

MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

ORDINANCE NO. _____

SECTION 1. PURPOSE/INTENT.

The purpose of this ordinance is to provide for the health, safety, and general welfare of the citizens of [jurisdiction] through the regulation of non-storm water discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

- (1) To regulate the contribution of pollutants to the MS4 by storm water discharges by any user.
- (2) To prohibit illicit connections and discharges to the MS4.
- (3) To establish legal authority to carry out all inspection, surveillance, monitoring, and enforcement procedures necessary to ensure compliance with this ordinance.

SECTION 2. DEFINITIONS.

For the purposes of this ordinance, the following shall mean:

Authorized Enforcement Agency. Employees or designees of the director of the municipal agency designated to enforce this ordinance.

Best Management Practices (BMPs). Schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to storm water, receiving waters, or storm water conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity. Activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials. Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Appendix B: Model Illicit Discharge and Connection Ordinance

Illegal Discharge. Any direct or indirect non-storm water discharge to the storm drain system, except as exempted in Section 8 of this ordinance.

Illicit Connections. An illicit connection is defined as either of the following:

- Any drain or conveyance, whether on the surface or subsurface that allows an illegal discharge to enter the storm drain system including but not limited to any conveyances that allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or,
- Any drain or conveyance connected from a commercial or industrial land use to the storm drain system that has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Industrial Activity. Activities subject to NPDES Industrial Storm Water Permits as defined in 40 CFR, Section 122.26 (b)(14).

Municipal Separate Storm Sewer System (MS4). The system of conveyances (including sidewalks, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and operated by the **[jurisdiction]** and designed or used for collecting or conveying storm water, and that is not used for collecting or conveying sewage.

National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit. means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Storm Water Discharge. Any discharge to the storm drain system that is not composed entirely of storm water.

Person. Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Storm Drainage System. Publicly-owned facilities by which storm water is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures.

Storm Water. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Storm Water Management Plan. A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Storm Water, Storm Water Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Wastewater. Any water or other liquid, other than uncontaminated storm water, discharged from a facility.

SECTION 3. APPLICABILITY.

This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the **[authorized enforcement agency]**.

SECTION 4. RESPONSIBILITY FOR ADMINISTRATION.

The **[authorized enforcement agency]** shall administer, implement, and enforce the provisions of this ordinance. Any powers granted or duties imposed upon the **[authorized enforcement agency]** may be delegated in writing by the Director of the **[authorized enforcement agency]** to persons or entities acting in the beneficial interest of or in the employ of the agency.

SECTION 5. COMPATIBILITY WITH OTHER REGULATIONS.

This ordinance is not intended to modify or repeal any other ordinance, rule, regulation, or other provision of law. The requirements of this ordinance are in addition to the requirements of any other ordinance, rule, regulation, or other provision of law, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule, regulation, or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human health or the environment shall control.

SECTION 6. SEVERABILITY.

The provisions of this ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this ordinance or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this ordinance.

SECTION 7. ULTIMATE RESPONSIBILITY.

The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend or imply that compliance by any person will ensure that there will be no contamination, pollution, or unauthorized discharge of pollutants.

SECTION 8. DISCHARGE PROHIBITIONS.

8.1. Prohibition of Illegal Discharges.

No person shall throw, drain, or otherwise discharge, cause, or allow others under its control to throw, drain, or otherwise discharge into the MS4 any pollutants or waters containing any pollutants, other than storm water.

The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

- (1) The following discharges are exempt from discharge prohibitions established by this ordinance: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water.
- (2) Discharges or flow from firefighting, and other discharges specified in writing by the **[authorized enforcement agency]** as being necessary to protect public health and safety.
- (3) Discharges associated with dye testing, however this activity requires a verbal notification to the **[authorized enforcement agency]** prior to the time of the test.
- (4) The prohibition shall not apply to any non-storm water discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the United States Environmental Protection Agency (EPA), provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

The local government may evaluate and remove any of the above exemptions if it is determined that they are causing an adverse impact.

8.2. Prohibition of Illicit Connections.

- (1) The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.
- (2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.
- (3) A person is considered to be in violation of this ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.
- (4) Improper connections in violation of this ordinance must be disconnected and redirected, if necessary, to an approved onsite wastewater management system or the sanitary sewer system upon approval of the **[authorized enforcement agency]**.
- (5) Any drain or conveyance that has not been documented in plans, maps or equivalent, and which may be connected to the storm sewer system, shall be located by the owner or occupant of that property upon receipt of written notice of violation from the **[authorized**

enforcement agency] requiring that such locating be completed. Such notice will specify a reasonable time period within which the location of the drain or conveyance is to be determined, that the drain or conveyance be identified as storm sewer, sanitary sewer or other, and that the outfall location or point of connection to the storm sewer system, sanitary sewer system or other discharge point be identified. Results of these investigations are to be documented and provided to the **[authorized enforcement agency]**.

SECTION 9. WATERCOURSE PROTECTION.

Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

SECTION 10. INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES.

10.1. Submission of NOI to [jurisdiction].

- (1) Any person subject to an industrial or construction activity NPDES storm water discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the **[authorized enforcement agency]** prior to the allowing of discharges to the MS4.
- (2) The operator of a facility, including construction sites, required to have an NPDES permit to discharge storm water associated with industrial activity shall submit a copy of the Notice of Intent (NOI) to the **[authorized enforcement agency]** at the same time the operator submits the original Notice of Intent to the EPA as applicable.
- (3) The copy of the Notice of Intent may be delivered to the **[authorized enforcement agency]** either in person or by mailing it to:
Notice of Intent to Discharge Storm Water
[authorized enforcement agency]
[street address]
[city, state, zip code]
- (4) A person commits an offense if the person operates a facility that is discharging storm water associated with industrial activity without having submitted a copy of the Notice of Intent to do so to the **[authorized enforcement agency]**.

SECTION 11. COMPLIANCE MONITORING

11.1. Right of Entry: Inspection and Sampling.

The **[authorized enforcement agency]** shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to determine compliance with this ordinance.

- (1) If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the **[authorized enforcement agency]**.
- (2) Facility operators shall allow the **[authorized enforcement agency]** ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge storm water, and the performance of any additional duties as defined by state and federal law.
- (3) The **[authorized enforcement agency]** shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the **[authorized enforcement agency]** to conduct monitoring and/or sampling of the facility's storm water discharge.
- (4) The **[authorized enforcement agency]** has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure storm water flow and quality shall be calibrated to ensure their accuracy.
- (5) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the **[authorized enforcement agency]** and shall not be replaced. The costs of clearing such access shall be borne by the operator.
- (6) Unreasonable delays in allowing the **[authorized enforcement agency]** access to a permitted facility is a violation of a storm water discharge permit and of this ordinance. A person who is the operator of a facility with an NPDES permit to discharge storm water associated with industrial activity commits an offense if the person denies the **[authorized enforcement agency]** reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this ordinance.

11.2. Search Warrants.

If the **[authorized enforcement agency]** has been refused access to any part of the premises from which storm water is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the **[authorized enforcement agency]** may seek issuance of a search warrant from any court of competent jurisdiction.

SECTION 12. REQUIREMENT TO PREVENT, CONTROL, AND REDUCE STORM WATER POLLUTANTS BY THE USE OF BEST MANAGEMENT PRACTICES.

[Authorized enforcement agency] will adopt requirements identifying Best Management Practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the United States. The owner or operator of such activity, operation, or facility shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premise that is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the MS4. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a storm water management plan (SWMP) as necessary for compliance with requirements of the NPDES permit.

SECTION 13. NOTIFICATION OF SPILLS.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into storm water, the storm drain system, or waters of the United States, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the [authorized enforcement agency] in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the [authorized enforcement agency] within [] business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least [] years.

Failure to provide notification of a release as provided above is a violation of this ordinance.

SECTION 14. VIOLATIONS, ENFORCEMENT, AND PENALTIES.

14.1. Violations.

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this ordinance. Any person who has violated or continues to violate the provisions of this ordinance, may be subject to the enforcement actions outlined in this section or may be restrained by injunction or otherwise abated in a manner provided by law.

In the event the violation constitutes an immediate danger to public health or public safety, the [authorized enforcement agency] is authorized to enter upon the subject private property,

without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. The **[authorized enforcement agency]** is authorized to seek costs of the abatement as outlined in Section 17.

14.2. Warning Notice.

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, the **[authorized enforcement agency]** may serve upon that person a written Warning Notice, specifying the particular violation believed to have occurred and requesting the discharger to immediately investigate the matter and to seek a resolution whereby any offending discharge will cease. Investigation and/or resolution of the matter in response to the Warning Notice in no way relieves the alleged violator of liability for any violations occurring before or after receipt of the Warning Notice. Nothing in this subsection shall limit the authority of the **[authorized enforcement agency]** to take any action, including emergency action or any other enforcement action, without first issuing a Warning Notice.

14.3. Notice of Violation.

Whenever the **[authorized enforcement agency]** finds that a person has violated a prohibition or failed to meet a requirement of this ordinance, the **[authorized enforcement agency]** may order compliance by written notice of violation to the responsible person.

The Notice of Violation shall contain:

- (1) The name and address of the alleged violator;
- (2) The address when available or a description of the building, structure or land upon which the violation is occurring, or has occurred;
- (3) A statement specifying the nature of the violation;
- (4) A description of the remedial measures necessary to restore compliance with this ordinance and a time schedule for the completion of such remedial action;
- (5) A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed;
- (6) A statement that the determination of violation may be appealed to the **[authorized enforcement agency]** by filing a written notice of appeal within [___] days of service of notice of violation; and
- (7) A statement specifying that, should the violator fail to restore compliance within the established time schedule, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Such notice may require without limitation:

- (1) The performance of monitoring, analyses, and reporting;
- (2) The elimination of illicit connections or discharges;
- (3) That violating discharges, practices, or operations shall cease and desist;
- (4) The abatement or remediation of storm water pollution or contamination hazards and the

- restoration of any affected property
- (5) Payment of a fine to cover administrative and remediation costs; and
 - (6) The implementation of source control or treatment BMPs.

14.5. Compensatory Action.

In lieu of enforcement proceedings, penalties, and remedies authorized by this ordinance, the **[authorized enforcement agency]** may impose upon a violator alternative compensatory actions, such as storm drain stenciling, attendance at compliance workshops, creek cleanup, etc.

14.6. Suspension Of MS4 Access.

14.6.1. Emergency Cease and Desist Orders

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, or that the person's past violations are likely to recur, and that the person's violation(s) has (have) caused or contributed to an actual or threatened discharge to the MS4 or waters of the United States which reasonably appears to present an imminent or substantial endangerment to the health or welfare of persons or to the environment, the **[authorized enforcement agency]** may issue an order to the violator directing it immediately to cease and desist all such violations and directing the violator to:

- (1) Immediately comply with all ordinance requirements; and
- (2) Take such appropriate preventive action as may be needed to properly address a continuing or threatened violation, including immediately halting operations and/or terminating the discharge.

Any person notified of an emergency order directed to it under this Subsection shall immediately comply and stop or eliminate its endangering discharge. In the event of a discharger's failure to immediately comply voluntarily with the emergency order, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize harm to the MS4 or waters of the United States, and/or endangerment to persons or to the environment, including immediate termination of a facility's water supply, sewer connection, or other municipal utility services. The **[authorized enforcement agency]** may allow the person to recommence its discharge when it has demonstrated to the satisfaction of the **[authorized enforcement agency]** that the period of endangerment has passed, unless further termination proceedings are initiated against the discharger under this ordinance. A person that is responsible, in whole or in part, for any discharge presenting imminent endangerment shall submit a detailed written statement, describing the causes of the harmful discharge and the measures taken to prevent any future occurrence, to the **[authorized enforcement agency]** within [] days of receipt of the emergency order. Issuance of an emergency cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the violator.

14.6.2. Suspension due to Illicit Discharges in Emergency Situations

The **[authorized enforcement agency]** may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the United States. If the violator fails to

comply with a suspension order issued in an emergency, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the United States, or to minimize danger to persons.

14.6.3. Suspension due to the Detection of Illicit Discharge

Any person discharging to the MS4 in violation of this ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The **[authorized enforcement agency]** will notify a violator of the proposed termination of its MS4 access. The violator may petition the **[authorized enforcement agency]** for a reconsideration and hearing.

A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the **[authorized enforcement agency]**.

14.7. Civil Penalties.

In the event the alleged violator fails to take the remedial measures set forth in the notice of violation or otherwise fails to cure the violations described therein within [___] days, or such greater period as the **[authorized enforcement agency]** shall deem appropriate, after the **[authorized enforcement agency]** has taken one or more of the actions described above, the **[authorized enforcement agency]** may impose a penalty not to exceed \$[___] (depending on the severity of the violation) for each day the violation remains unremedied after receipt of the notice of violation.

14.8. Criminal Prosecution.

Any person that has violated or continues to violate this ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty of \$[___] per violation per day and/or imprisonment for a period of time not to exceed [___] days. Each act of violation and each day upon which any violation shall occur shall constitute a separate offense.

SECTION 15. APPEAL OF NOTICE OF VIOLATION.

Any person receiving a Notice of Violation may appeal the determination of the **[authorized enforcement agency]**. The notice of appeal must be received within [___] days from the date of the Notice of Violation. Hearing on the appeal before the appropriate authority or his/her designee shall take place within [___] days from the date of receipt of the notice of appeal. The decision of the municipal authority or their designee shall be final.

SECTION 16. ENFORCEMENT MEASURES AFTER APPEAL.

If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within [___] days of the decision of the municipal authority upholding the decision of the **[authorized enforcement agency]**, then representatives of the **[authorized enforcement agency]** shall enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any

premises to refuse to allow the government agency or designated contractor to enter upon the premises for the purposes set forth above.

SECTION 17. COST OF ABATEMENT OF THE VIOLATION.

Within [] days after abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment within [] days. If the amount due is not paid within a timely manner as determined by the decision of the municipal authority or by the expiration of the time in which to file an appeal, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment.

Any person violating any of the provisions of this article shall become liable to the [jurisdiction] by reason of such violation. The liability shall be paid in not more than [] equal payments. Interest at the rate of [] percent per annum shall be assessed on the balance beginning on the [] day following discovery of the violation.

SECTION 18. VIOLATIONS DEEMED A PUBLIC NUISANCE.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this ordinance is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

SECTION 19. REMEDIES NOT EXCLUSIVE.

The remedies listed in this ordinance are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the [authorized enforcement agency] to seek cumulative remedies.

The [authorized enforcement agency] may recover all attorney's fees court costs and other expenses associated with enforcement of this ordinance, including sampling and monitoring expenses.

SECTION 20. ADOPTION OF ORDINANCE.

This ordinance shall be in full force and effect [] days after its final passage and adoption. All prior ordinances and parts of ordinances in conflict with this ordinance are hereby repealed.

PASSED AND ADOPTED this ____ day of _____, 20__, by the following vote:

APPENDIX C

SIX STEPS TO ESTABLISHING A HOTLINE AND REPORTING AND TRACKING SYSTEM

Introduction

A complaint hotline is a dedicated phone number or website where citizens can easily report illicit discharge and pollution concerns. A prompt investigation of each complaint by trained inspectors should always follow a reported incident, usually within 24 hours. Many Phase I communities utilize hotlines to track down intermittent and transitory discharges, and regard them as one of their most effective tools to isolate illicit discharges (CWP, 2002).

This appendix describes the six steps needed to establish a hotline to report and track illicit discharges.

Step 1. Define the scope

The community must first determine its need for an IDDE complaint hotline and should not establish one simply because it does not currently exist. An IDDE hotline may be appropriate for a community for the following reasons:

- The municipality already receives a high volume of complaint calls associated with illicit discharges. Without a designated number, complaints may be received by several different departments, which can lead to inconsistent handling of concerns. If a community is unsure of the number of complaints received across the municipality, it may want to quickly survey departments likely to receive calls. A hotline can help promote stakeholder reporting of incidents and make the reporting process more efficient rather than relying on calls making it to the correct office.

- A community hotline exists that cannot be altered to accommodate the needs of the IDDE program. Situations that would make two hotlines incompatible include: significantly different concerns (e.g., IDDE vs. emergency services); varying jurisdictional limits (e.g., regional vs. city only); and funding restrictions (e.g., hotline is developed with a grant that prevents it from overlapping with other programs).
- Related municipal programs exist that would benefit from the establishment of a hotline, such as erosion and sediment control or storm water management programs. Combining similar services can lead to a significant savings in cost and time.

Communities that have no pressing need for a hotline may still choose to institute a department phone number or email address to field complaints and incident reports during normal business hours, or a website that provides guidance on how to report potential illicit discharges.

Once a community has decided to implement a hotline, the scope of the IDDE hotline should be defined, including the intent and extent of the program. The intent of the hotline may be to process the incident/complaint, and investigate and enforce violations, or to take a more educational approach that also provides information and guidance. It is recommended that communities initiating a hotline for the first time limit the scope to the former intent.

The extent of the hotline refers to the geographic area of coverage as well as the types of incidents that fall under the responsibility of the responding agency or department. Often hotlines are restricted to

one specific jurisdiction to minimize complications with investigating and enforcing violations across jurisdictional lines. Significant coordination and planning are required if the hotline is intended to serve a region or watershed with several jurisdictions. Similar coordination efforts are necessary if a wide range of incidents is handled by the hotline that require multiple agencies or departments to respond. It is important for communities to predetermine what agency or department is best suited and trained to respond to specific incident reports, and for all hotline operators to be well trained and knowledgeable about these distinctions.

Step 2. Create a tracking and reporting system

The next step to establishing an IDDE hotline is to create a tracking and reporting system. The two key features that should be considered are the methods of reporting and methods of responding.

At a minimum, the reporting method should include a telephone call-in system and may also include a website. The phone number and/or internet address should be easy to remember and toll-free if any areas under the jurisdiction of the IDDE program are long-distance from the reporting office. The reporting method should be available 24 hours a day, seven days a week. This around the clock process encourages stakeholders to call as soon as a problem is identified.

Providing an option for anonymous reporting also encourages calls because it can be done without fear of retribution from neighbors, employers, or others. In most cases this is achieved by providing an “Incident ID” that may also be used to allow the caller to track the investigation and know that their concerns are being

addressed, as well as build in accountability within the department to respond to hotline callers.

The level of detail collected during an incident report will vary depending on system design and complaint responder training. Many hotlines collect only basic information, however, more detailed information will help prioritize investigations and take advantage of a database system to expand reporting options. A sample Illicit Discharge Incident Tracking Sheet is provided at the end of this Appendix to help facilitate this process. The sheet is intended for use with a phone reporting system, and is designed so that the responder can prompt the caller through each section. This sheet may be modified into a simple, multiple-choice questionnaire if reporting is done through a website or email. The basic information collected during an incident report is described below.

- *Incident ID* - Each incident should receive a unique identification code to ensure accurate tracking and public feedback.
- *Reporter Information* - Reporter contact information may be recorded, however, anonymous reporting is often preferred because it frees the reporter from potential backlash. The date and time of incident must be noted, as it may be different than the time it was called in.
- *Responder Information* - The name of the responder and the time and date of the call should be recorded. The amount of precipitation in the past 24-48 hours is also recorded for reporting purposes.
- *Incident Location* - The location of the potential illicit discharge is one of the most important yet difficult pieces of information to accurately collect. Unique

and visible outfall numbering allows reports to be precisely located. In the absence of outfall IDs, callers should be encouraged to provide the nearest street/intersection information and any general descriptions that tie the site to a nearby landmark or major land use (e.g., shopping center, school, etc.), as well as indicate whether the incident site is located in the stream corridor or in an upland area. Other options are to include blank space for narrative descriptions or for the response team to meet the caller at a nearby known location if the caller cannot provide sufficient locational information.

- *Problem Type* - Providing a list of likely problems and problem descriptions can help to readily identify the potential source. The problem types will likely fall into the following five categories: unnatural stream conditions, sewage, wash water, oil/solvents, and industrial wastes. “Other” should also be included, as exceptions will occur. By identifying a suspected origin, the field team may have a head start on the investigation and suspected repeat offenders can be screened through trend analysis.
- *Problem Indicator Description* - A description of the discharge odor and color, and type of floatables present permits investigators to know what they are looking for and start preparing for how to handle the situation.
- *Investigation Notes* - To properly track and report suspected illicit discharges, the investigation needs to be documented. Key information to record for the initial and follow-up investigation (if applicable) include: date, time, step taken to respond to incident report (not all require follow

up), investigators, length of time spent for investigation, corrective actions taken, date case closed, and any other pertinent information.

Due to the intermittent nature of illicit discharges, a 24-hour investigation response can increase the likelihood of identifying and eliminating problems. While some problems require more immediate attention than others, investigators should always respond as soon as appropriate. Calls should be screened by a “live” person so only the most urgent calls are passed through a pager system in order to minimize the pressure that 24-hour response places on investigators at odd hours. The complaint questions should be detailed enough to help support this basic prioritization.

Some communities may determine that 24-hour response is cost prohibitive, and that non-emergency response will only occur during normal working hours (e.g., 8AM - 5PM). In these situations, it is essential that explicit instructions be provided to the caller in case of a true emergency.

Another aspect of responding to complaints is determining when another department or agency should handle the problem. An incident may need to be passed on because the reported problem falls under the responsibility of another department, such as the fire or health department. Having specific guidelines for the call responder and investigators is imperative to handling these incidents appropriately.

Step 3. Train personnel

Training of complaint respondents should include how to provide good customer service, the basics of illicit discharge identification and details of the tracking and reporting process. The responder should be

trained so that he/she understands the significance of the information being collected and can go beyond the “check boxes” when necessary to answer the reporter questions, as well as guide the caller through the data collection process. This ensures that the incident is handled correctly, and that the caller feels that the concern is in good hands.

An initial screening of the potential illicit source by the responder can be useful. Table C1 provides a list of descriptions of common illicit discharges called in and the likely source or situation.

Inter- and intra-department training should focus on the importance of IDDE, the complaint hotline investigation and tracking process, and the expected responsibilities of each involved entity. Such training can greatly increase watershed wide awareness of illicit discharge problems and is essential to developing good working relationships with other departments.

Step 4. Advertise

Public relations are an important aspect of a pollution hotline. Many municipalities have noted that there is always a peak in incident reporting following an advertising campaign. Advertising the hotline phone number or web address several times a year keeps the message fresh in public minds. Effective methods include magnets, stickers, phone book advertisements, flyers, bill inserts, displays, fair booths and newspaper articles.

Advertising, including publicizing success stories about the hotline serves several purposes. First it highlights the responsiveness of the program to the general public. Second, it serves as a means to further promote the hotline. Third, it builds public support for the program and fosters public stewardship. Success stories can be published through newspaper articles, TV broadcasts or other highly visible means of advertising. The stories will build general awareness of illicit discharge issues and promote greater public stewardship and accountability by both those reporting the problems and potential violators.

Table C1: Types of Potential IDDE Hotline Complaints	
Typical Call-in Indicators	Likely Source
Sewage smell, or floatables from storm drain outfall during dry weather flow	Storm and sanitary sewer cross-connection
Small (<6" diameter) pipe directly discharging to receiving water	Straight pipe discharge from home or business
Greatly discolored or unnatural smelling liquid (often hydrocarbons) flowing from or pooling on property or from outfall below property	Dumping
Sewage smell; extra green vegetation; saturated ground	Failing septic system
Muddy water; sediment deposits, up stream construction site	Poor erosion and sediment control

Step 5. Respond to complaints

Hotline customer service staff should provide friendly and knowledgeable service to callers that might include an overview of the investigation process, how long a response should take, and an incident tracking ID so the caller can follow-up on the complaint. Hotline staff should arrange to send an investigator out to the incident site as soon as possible.

Investigators should respond to complaints in a timely manner, and provide the necessary feedback to the database system. The type of complaint will dictate the necessary response, as well as the timing of the response (e.g., a failing septic system may not be as high a priority as a sanitary sewer overflow). Information submitted to the reporting database might include: time from initial call to investigation, steps taken to investigate, and actions taken to solve the problem.

Step 6. Track incidents

Illicit discharge complaints and incidents should be reported and tracked through a database system in order to meet the following program goals:

- Identify recurring problems and suspected offenders
- Measure program success
- Comply with annual report requirements

Basic data to be compiled and analyzed include the following:

- Number of calls received per year
- Number of incidents investigated
- Number of actual IDDE incidents
- Average time to follow up on incident report
- Average time to remedy identified illicit problem
- Most common problems identified by public

Costs

Table C2 provides planning level costs to establish and maintain a hotline and tracking system. Certain costs can undoubtedly be reduced through sharing of services across departments and even jurisdictions.

Table C2: Cost to Create and Maintain a Successful IDDE Hotline			
Steps	Key Elements/ Consideration	Initial Costs	Annual Costs
1. Define the scope	Planning Costs: 60 hrs @ \$25/hr to coordinate with other departments and design program basics	\$1,500	\$0
2. Create a tracking and reporting system	Initial web design: 80hrs @ \$25/hr Annual web hosting @ 200/yr ¹	\$2,000	\$200
	800 toll free number set-up: free Monthly costs: \$20/month (\$240/yr) + \$0.20 per minute (assume average call of 10 minutes and 1000 calls/yr, or \$2,000/yr) ²	\$0	\$2,240
	Database design: 20 hrs @ \$25/hr ¹	\$500	\$0
3. Train personnel	<i>Initial:</i> 3 days (Approx \$25/hr) including full day introductory Access training course (\$400) = \$1,000 ³ <i>Annual:</i> approx 1/2 day refresher = \$200	\$1,000	\$200
	<i>Initial:</i> presentation prep (24 hrs @ \$50/hr) <i>Annual:</i> mini-refresher training (16 hrs @ \$25/hr to rotate through other departments)	\$1,200	\$800
4. Advertise	<i>Initial:</i> Design brochure and magnets (\$1,000) ⁴ . Design 30 second PSA video spot (\$500) ⁵ <i>Annual:</i> 4,000 magnets (\$920), 10,000 brochures printed and mailed (\$1,500) + 20 hrs or coordination (\$500)	\$1,500	\$2,920
5. Respond to complaints	Assumes 1,000 calls per year at 10 min per complaint ⁶ to handle including receiving the call, forwarding to appropriate place, logging into a database, and tracking investigation. This time represents approximately 15% of a full time position.	\$0	\$5,000
6. Track incidents			
TOTAL		\$7,700	\$11,360
<p>Ways to reduce cost: Use in-house or donated database, brochure and web design services; combine with other pollution prevention hotlines (e.g., storm water); combine with other local, regional or state IDDE hotline programs; use existing web page hosting services; hire staff with database experience</p> <p>Notes:</p> <p>¹ Personal communication with Center for Watershed Protection staff performing similar duties</p> <p>² Sprint Small Business website</p> <p>³ ExecuTrain - computer training business</p> <p>⁴ CWP, 1998</p> <p>⁵ CSG, 1998</p> <p>⁶ adapted from TCEQ, 2003</p>			

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Center for Watershed Protection. 2002. Unpublished Task I Technical Memorandum in Support of *Illicit Discharge Detection and Elimination Guidance Manual*. Ellicott City, MD.

Council of State Governments (CSG). 1998. *Getting in Step: A Guide to Effective Outreach in Your Watershed*.

Sprint Small Business web site (www.sprintbiz.com). Accessed May 14, 2003.

Texas Commission of Environmental Quality (TCEQ) Personal Communication. May 9, 2003. Email Jim Reed.

Illicit Discharge Hotline Incident Tracking Sheet

Incident ID:				
Responder Information				
Call taken by:			Call date:	
Call time:			Precipitation (inches) in past 24-48 hrs:	
Reporter Information				
Incident time:			Incident date:	
Caller contact information (<i>optional</i>):				
Incident Location (<i>complete one or more below</i>)				
Latitude and longitude:				
Stream address or outfall #:				
Closest street address:				
Nearby landmark:				
Primary Location Description		Secondary Location Description:		
<input type="checkbox"/> Stream corridor (<i>In or adjacent to stream</i>)		<input type="checkbox"/> Outfall	<input type="checkbox"/> In-stream flow	<input type="checkbox"/> Along banks
<input type="checkbox"/> Upland area (<i>Land not adjacent to stream</i>)		<input type="checkbox"/> Near storm drain	<input type="checkbox"/> Near other water source (storm water pond, wetland, etc.):	
Narrative description of location:				
Upland Problem Indicator Description				
<input type="checkbox"/> Dumping		<input type="checkbox"/> Oil/solvents/chemicals	<input type="checkbox"/> Sewage	
<input type="checkbox"/> Wash water, suds, etc.		<input type="checkbox"/> Other: _____		
Stream Corridor Problem Indicator Description				
Odor	<input type="checkbox"/> None	<input type="checkbox"/> Sewage	<input type="checkbox"/> Rancid/Sour	<input type="checkbox"/> Petroleum (gas)
	<input type="checkbox"/> Sulfide (rotten eggs); natural gas	<input type="checkbox"/> Other: Describe in "Narrative" section		
Appearance	<input type="checkbox"/> "Normal"	<input type="checkbox"/> Oil sheen	<input type="checkbox"/> Cloudy	<input type="checkbox"/> Suds
	<input type="checkbox"/> Other: Describe in "Narrative" section			
Floatables	<input type="checkbox"/> None:	<input type="checkbox"/> Sewage (toilet paper, etc)	<input type="checkbox"/> Algae	<input type="checkbox"/> Dead fish
	<input type="checkbox"/> Other: Describe in "Narrative" section			
Narrative description of problem indicators:				
Suspected Violator (name, personal or vehicle description, license plate #, etc.):				

Investigation Notes	
Initial investigation date:	Investigators:
<input type="checkbox"/> No investigation made	Reason:
<input type="checkbox"/> Referred to different department/agency:	Department/Agency:
<input type="checkbox"/> Investigated: No action necessary	
<input type="checkbox"/> Investigated: Requires action	Description of actions:
Hours between call and investigation:	Hours to close incident:
Date case closed:	
Notes:	

APPENDIX D

OUTFALL RECONNAISSANCE INVENTORY FIELD SHEET

OUTFALL RECONNAISSANCE INVENTORY/ SAMPLE COLLECTION FIELD SHEET

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.):	Last 24 hours:	Last 48 hours:
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	
Land Use in Drainage Area (Check all that apply):			
<input type="checkbox"/> Industrial		<input type="checkbox"/> Open Space	
<input type="checkbox"/> Ultra-Urban Residential		<input type="checkbox"/> Institutional	
<input type="checkbox"/> Suburban Residential		Other: _____	
<input type="checkbox"/> Commercial		Known Industries: _____	
Notes (e.g., origin of outfall, if known):			

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE	DIMENSIONS (IN.)	SUBMERGED
<input type="checkbox"/> Closed Pipe	<input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____	<input type="checkbox"/> Circular <input type="checkbox"/> Single <input type="checkbox"/> Elliptical <input type="checkbox"/> Double <input type="checkbox"/> Box <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____	Diameter/Dimensions: _____	In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open drainage	<input type="checkbox"/> Concrete <input type="checkbox"/> Earthen <input type="checkbox"/> rip-rap <input type="checkbox"/> Other: _____	<input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____	Depth: _____ Top Width: _____ Bottom Width: _____	
<input type="checkbox"/> In-Stream	(applicable when collecting samples)			
Flow Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <i>If No, Skip to Section 5</i>			
Flow Description (If present)	<input type="checkbox"/> Trickle <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial			

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER	RESULT	UNIT	EQUIPMENT	
<input type="checkbox"/> Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
<input type="checkbox"/> Flow #2	Flow depth		In	Tape measure
	Flow width	_____', _____"	Ft, In	Tape measure
	Measured length	_____', _____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature		°F	Thermometer	
pH		pH Units	Test strip/Probe	
Ammonia		mg/L	Test strip	

Outfall Reconnaissance Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? Yes No *(If No, Skip to Section 5)*

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor	<input type="checkbox"/>	<input type="checkbox"/> Sewage <input type="checkbox"/> Rancid/sour <input type="checkbox"/> Petroleum/gas <input type="checkbox"/> Sulfide <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint	<input type="checkbox"/> 2 – Easily detected	<input type="checkbox"/> 3 – Noticeable from a distance
Color	<input type="checkbox"/>	<input type="checkbox"/> Clear <input type="checkbox"/> Brown <input type="checkbox"/> Gray <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Orange <input type="checkbox"/> Red <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint colors in sample bottle	<input type="checkbox"/> 2 – Clearly visible in sample bottle	<input type="checkbox"/> 3 – Clearly visible in outfall flow
Turbidity	<input type="checkbox"/>	See severity	<input type="checkbox"/> 1 – Slight cloudiness	<input type="checkbox"/> 2 – Cloudy	<input type="checkbox"/> 3 – Opaque
Floatables -Does Not Include Trash!!	<input type="checkbox"/>	<input type="checkbox"/> Sewage (Toilet Paper, etc.) <input type="checkbox"/> Suds <input type="checkbox"/> Petroleum (oil sheen) <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Few/slight; origin not obvious	<input type="checkbox"/> 2 – Some; indications of origin (e.g., possible suds or oil sheen)	<input type="checkbox"/> 3 – Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? Yes No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	<input type="checkbox"/>	<input type="checkbox"/> Spalling, Cracking or Chipping <input type="checkbox"/> Peeling Paint <input type="checkbox"/> Corrosion	
Deposits/Stains	<input type="checkbox"/>	<input type="checkbox"/> Oily <input type="checkbox"/> Flow Line <input type="checkbox"/> Paint <input type="checkbox"/> Other:	
Abnormal Vegetation	<input type="checkbox"/>	<input type="checkbox"/> Excessive <input type="checkbox"/> Inhibited	
Poor pool quality	<input type="checkbox"/>	<input type="checkbox"/> Odors <input type="checkbox"/> Colors <input type="checkbox"/> Floatables <input type="checkbox"/> Oil Sheen <input type="checkbox"/> Suds <input type="checkbox"/> Excessive Algae <input type="checkbox"/> Other:	
Pipe benthic growth	<input type="checkbox"/>	<input type="checkbox"/> Brown <input type="checkbox"/> Orange <input type="checkbox"/> Green <input type="checkbox"/> Other:	

Section 6: Overall Outfall Characterization

<input type="checkbox"/> Unlikely <input type="checkbox"/> Potential (presence of two or more indicators) <input type="checkbox"/> Suspect (one or more indicators with a severity of 3) <input type="checkbox"/> Obvious

Section 7: Data Collection

1. Sample for the lab?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
2. If yes, collected from:	<input type="checkbox"/> Flow	<input type="checkbox"/> Pool	
3. Intermittent flow trap set?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	If Yes, type: <input type="checkbox"/> OBM <input type="checkbox"/> Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

APPENDIX E

FLOW TYPE DATA FROM TUSCALOOSA AND BIRMINGHAM, AL

Appendix E1: Data Tables for Tuscaloosa

Table E1.1: Tap Water Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (μS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	B.B.Commer Hall	5/17/2002	8.19	132	N/A	N/A	0	0.97	63.6	0	N/A	N/A
2	Rose Towers	5/17/2002	7.92	145	N/A	N/A	0	0.97	68.4	0	N/A	N/A
3	H.C.Commer Hall	5/17/2002	8.46	125	N/A	N/A	0	0.96	60.8	0	N/A	N/A
4	Rec Centre	5/17/2002	8.11	130	N/A	N/A	0	0.92	64.8	0	N/A	N/A
5	Coleman Coliseum	5/17/2002	8.28	130	N/A	N/A	0	0.94	72.8	0	N/A	N/A
6	Mib (UA)	5/29/2003	7.81	146	N/A	1.15	0	1.04	28	0	2115	4.88
7	Alex Appt.	5/30/2003	7.38	156	N/A	0.761	0	0.82	44	0	92	0.21
8	Georgas Library (UA)	6/3/2003	8.13	152	N/A	0.811	0		42	0	1255	2.9
9	Rodgers Library	6/8/2003	7.5	141	N/A	0.566	0	0.84	40	0	165	0.38
10	Alexander Property Appt.	6/8/2003	7.5	138	N/A	0.61	0	0.89	46	0	637	1.47
11	Pslidea Court Appt.	6/8/2003	7.68	139	N/A	0.433	0	1.00	44	0	566	1.3
12	University Plaza Appt.	6/8/2003	7.5	140	N/A	0.856	0	0.94	46	0	1003	2.31
Mean			7.87	140	-	0.74	0	0.94	52	0	833	1.92
Standard Deviation			0.36	9.3	-	0.23	0	0.065	14	0	702	1.62
COV			0.05	0.07	-	0.32	-	0.07	0.27	-	0.84	0.84
Anderson Darling Probability Test Value (Normal)			1.138	1.004	-	1.57	-	1.144	1.331	-	-	1.601
Anderson Darling Probability Test Value (Log-normal)			-	0.998	-	1.543	-	1.185	1.307	-	-	1.639

Data provided by Robert Pitt, University of Alabama

Table E1.1: Tap Water Reference (“Library”) Samples, CONT.

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	B.B.Commer Hall	5/17/2002	1	<LD	N/A	N/A	N/A	N/A	N/A
2	Rose Towers	5/17/2002	1	<LD	N/A	N/A	N/A	N/A	N/A
3	H.C.Commer Hall	5/17/2002	1	<LD	N/A	N/A	N/A	N/A	N/A
4	Rec Centre	5/17/2002	1	<LD	N/A	N/A	N/A	N/A	N/A
5	Coleman Coliseum	5/17/2002	1	<LD	N/A	N/A	N/A	N/A	N/A
6	Mib (UA)	5/29/2003	2	0.01	0.005	0.19	1	<1	<1
7	Alex Appt.	5/30/2003	2	<LD	N/A	0.1	<1	<1	<1
8	Georgas Library (UA)	6/3/2003	1	<LD	N/A	0.12	<1	<1	<1
9	Rodgers Library	6/8/2003	1	<LD	N/A	0.04	21.6	<1	<1
10	Alexander Property Appt.	6/8/2003	1	0.07	0.07	0.14	<1	<1	<1
11	Pslidea Court Appt.	6/8/2003	2	0.07	0.035	0.27	<1	<1	<1
12	University Plaza Appt.	6/8/2003	2	0.07	0.035	0.11	<1	<1	<1
Mean			1.3	<0.055	0.036	0.14	<11	<1	<1
Standard Deviation			0.49	0.03	0.026	0.07	15	-	-
COV			0.37	0.55	0.73	0.53	1.3	-	-
Anderson Darling Probability Test Value (Normal)			3.809	3.199	2.539	1.663	4.103	-	-
Anderson Darling Probability Test Value (Log-normal)			3.809	3.199	2.703	1.685	4.103	-	-

Data provided by Robert Pitt, University of Alabama

Table E1.2: Spring Water Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (µS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	Marrs Spring	9/30/2002	5.77	128	30	56	0	0.01	24.6	0	N/A	0.94
2	Jack Warner Pkwy	10/11/2002	6.46	124	30	67	0	0.01	34.4	0	N/A	0.56
3	Marrs Spring	11/3/2002	6.21	166	N/A	0.85	0	0.01	40.2	0	N/A	4.84
4	Jack Warner Pkwy	11/3/2002	6.36	112	N/A	42	0	0.01	28.6	0	N/A	6.64
5	Marrs Spring	3/11/2003	6.64	230	N/A	0.591	0	0.08	38	0	N/A	0.46
6	Jack Warner Pkwy	5/16/2003	6.45	126	N/A	19.3	0	0.21	32	0	20754	47.97
7	Jack Warner Pkwy	5/17/2003	6.16	128	N/A	19.6	0	0.17	44	0	2296	5.30
8	Marrs Spring	5/18/2003	6.82	182	N/A	1.78	0	0.39	42	0	1542	3.56
9	Marrs Spring	5/30/2003	6.43	143	N/A	1.12	5	0.31	40	0	1130	2.61
10	Marrs Spring	6/3/2003	6.81	200	N/A	21.2	27	0.07	42	0	6537	15.11
11	Jack Warner Pkwy	6/3/2003	5.63	125	72	4.08	0	0.14	48	0	7855	18.15
12	Jack Warner Pkwy	6/5/2003	6.04	130	68	4.89	0	0.24	48	0	5343	12.35
Mean			6.3	149	50	19.8	2.6	0.13	38	0	6493	9.8
Standard Deviation			0.37	36	23	23	7.7	0.12	7.3	0	6800	13.3
COV			0.05	0.24	0.46	1.16	2.92	0.93	0.19	-	-	1.3
Anderson Darling Probability Test (Normal)			1.046	1.046	1.795	-	1.726	5.451	1.215	1.08	-	-
Anderson Darling Probability Test (Log-normal)			-	-	1.633	-	1.192	4.201	1.664	1.213	-	-

Data provided by Robert Pitt, University of Alabama

Table E1.2: Spring Water Reference (“Library”) Samples, CONT.

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Marrs Spring	9/30/2002	8	0.01	0.001	N/A	1203.3	4.1	4.1
2	Jack Warner Pkwy	10/11/2002	1	0.02	0.02	N/A	275.5	1	36.4
3	Marrs Spring	11/3/2002	3	0.04	0.013	N/A	N/A	N/A	N/A
4	Jack Warner Pkwy	11/3/2002	2	0.02	0.01	N/A	N/A	N/A	N/A
5	Marrs Spring	3/11/2003	3	0.08	0.026	N/A	N/A	N/A	N/A
6	Jack Warner Pkwy	5/16/2003	3	0.01	0.0033	0.15	116.2	<1	<1
7	Jack Warner Pkwy	5/17/2003	2	0.29	0.14	0.15	>2419.2	290.9	412
8	Marrs Spring	5/18/2003	4	0.01	0.0025	0.14	>2419.2	172.3	140.8
9	Marrs Spring	5/30/2003	3	0.05	0.016	0.09	111.2	<1	3.1
10	Marrs Spring	6/3/2003	2	0.05	0.025	0.16	>2419.2	9.7	65.7
11	Jack Warner Pkwy	6/3/2003	4	0.05	0.012	0.09	4.1	1	<1
12	Jack Warner Pkwy	6/5/2003	3	0.05	0.016	0.04	7.2	<1	<1
Mean			3.1	0.057	0.024	0.117	>286	<80	<110
Standard Deviation			1.7	0.077	0.039	0.045	460	123	156
COV			0.55	1.35	1.592	0.381	1.60	1.54	1.41
Anderson Darling Probability Test Value (Normal)			1.9	3.01	3.498	1.864	2.06	3.27	2.66
Anderson Darling Probability Test Value (Log-normal)			1.4	1.2	1.3	2.04	1.55	2.14	1.47

Data provided by Robert Pitt, University of Alabama

Table E1.3: Car Wash Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (μS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)
1	Gee's Car Wash-Self Service	10/31/2002	6.62	320	26	263	100	<LD	56		N/A
2	Texaco Gas Station - Automatic Carwash	10/31/2002	6.90	300	28	232	>100	0.04	15	150	N/A
3	Chevey Gas Station - Automatic Carwash	5/16/2003	7.00	260	N/A	383	80.00	6.45	68	120	46162
4	Self service carwash-University Blvd.	5/17/2003	9.04	380	N/A	81	>100	1.70	76	150	19192
5	Self service carwash-University Blvd.	5/17/2003	7.37	390	N/A	239	>100	0.56	78	140	294014
6	Chevey Gas Station - Automatic Carwash	5/17/2003	9.34	570	N/A	264	>100	<LD	82	80	39262
7	Chevey Gas Station-McFarland - Automatic Carwash	5/29/2003	7.79	210	N/A	62	77.00	1.47	83	200	41341
8	Parade gas station (McFarland) - Automatic Carwash	6/3/2003	8.57	200	N/A	207	>100	0.05	84	150	54268
9	Stop and go self service carwash-Skyland Blvd.	6/3/2003	6.81	200	70	65	80.00	0.42	76	120	70180
10	Parade gas station-(Skyland Blvd.) - Automatic Carwash	6/3/2003	7.53	192	70	69	60.00	0.19	74	150	35731
11	Shell gas station (Skyland Blvd.) - Automatic Carwash	6/3/2003	7.2	120	71	1	30.00	0.50	82	150	14937
12	Parade gas station (Skyland Blvd.) - Automatic Carwash	6/8/2003	7.89	154	N/A	14	0.00	0.87	80	140	13681
Mean			7.67	274	53	156	>61	1.22	71	140	62876
Standard Deviation			0.89	126	23	122	34	1.92	19	29	83144
COV			0.11	0.45	0.44	0.77	0.56	1.56	0.27	0.20	1.32
Anderson Darling Probability Test (Normal)			1.22	1.27	-	1.33	1.96	2.66	1.72	1.87	-
Anderson Darling Probability Test (Log-normal)			-	1.02	-	1.79	2.18	1.20	1.81	3.12	-

Data provided by Robert Pitt, University of Alabama

Table E1.3: Car Wash Reference (“Library”) Samples, CONT.

Sample number	Sampling Location	Date	Fluorescence (mg/L as “Tide”)	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Gee's Car Wash-Self Service	10/31/2002	132	10	0.44	0.044	N/A	>2419.2	1553.1	>2419.2
2	Texaco Gas Station - Automatic Carwash	10/31/2002	130	2	0.65	0.33	N/A	>2419.2	1413.60	6.20
3	Chevey Gas Station - Automatic Carwash	5/16/2003	106	2	0.37	0.19	0.50	>2419.2	4.1	5.2
4	Self service carwash-University Blvd.	5/17/2003	44	5	0.28	0.06	0.65	>2419.2	14.6	3.1
5	Self service carwash-University Blvd.	5/17/2003	55	2	0.03	0.02	1.23	>2419.2	>2419.2	1
6	Chevey Gas Station - Automatic Carwash	5/17/2003	90	3	4.50	1.50	1.74	>2419.2	1413.6	>2419.2
7	Chevey Gas Station-McFarland - Automatic Carwash	5/29/2003	95	3	0.75	0.25	0.37	>2419.2	15.8	<1
8	Parade gas station (McFarland) - Automatic Carwash	6/3/2003	125	2	0.25	0.13	0.48	>2419.2	11.9	11.1
9	Stop and go self service carwash-Skyland Blvd.	6/3/2003	162	6	1	0.17	0.70	>2419.2	235.9	<1
10	Parade gas station-(Skyland Blvd.) - Automatic Carwash	6/3/2003	82	2	0.25	0.13	0.50	>2419.2	15.5	<1
11	shell gas station (Skyland Blvd.) - Automatic Carwash	6/3/2003	34	3	0.05	0.02	0.09	>2419.2	1553.1	2419.2
12	parade gas station (Skyland Blvd.) - Automatic Carwash	6/8/2003	31	3	2.25	0.75	0.28	<1	<1	<1
Mean			90	3.6	0.90	0.29	0.65	>2419.2	>623	>407
Standard Deviation			42	2.4	1.2	0.42	0.48	-	744	985
COV			0.46	0.667	1.4	1.4	0.74	-	1.1	2.4
Anderson Darling Probability Test (Normal)			1.029	2.313	2.6	2.58	1.678	-	2.158	4.467
Anderson Darling Probability Test (Log-normal)			1.254	1.71	1.103	0.999	1.34	-	1.626	2.372

Data provided by Robert Pitt, University of Alabama

Table E1.4: Laundry Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. ($\mu\text{S}/\text{cm}$)	Temp. ($^{\circ}\text{F}$)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO_3)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	Renee's House (unknown)	11/3/2002	6.52	220	26	90.40	20	1.27	13.00	1000.00	N/A	1231
2	Renee's House (unknown)	12/14/2002	6.22	180	26	66.20	30	0.98	18.00	920.00	N/A	1002
3	Renee's House (unknown)	5/11/2003	9.06	440	N/A	366.00	20	0.82	54	900	644924	1490
4	Renee's House (unknown)	5/11/2003	7.73	1690	N/A	85.70	20	0.78	60	1020	744120	1720
5	Renee's House (unknown)	5/11/2003	9.63	360	N/A	398.00	20	1.07	58	1000	131046	302
6	Yukio's apartment (Purex)	5/30/2003	7.10	590	N/A	226.00	20	0.84	42	920	886425	2049
7	Yukio's apartment (Purex)	5/31/2003	8.7	370	81	344	20	0.76	46	800	606787	1402
8	Suman (Tide)	5/30/2003	7.1	430	70	25	>100	0.05	52	620	1280468	2805
9	Yukio's apartment (Purex)	6/3/2003	8.2	470	84	128	>100	0.38	50	760	583967	1349
10	Soumya (Tide)	6/3/2003	8.03	420	110	304	>100	1.04	56	420	745300	1722
11	Veera (Gain)	6/3/2003	9.45	240	N/A	135	45	1.12	54	580	186050	430
12	Sanju (Tide)	6/8/2003	7.2	152	N/A	59.1	40	1.09	44	480	260002	601
Mean			7.91	463.5	26	185	>26	0.85	45	785	532069	1342
Standard Deviation			1.12	408	26	134	9.93	0.34	15	212	271933	709
COV			0.14	0.880	N/A	0.72	0.38	0.40	0.33	0.27	0.51	0.52
Anderson Darling Probability Test Value (Normal)			1.013	2.641	N/A	1.401	2.578	1.42	1.841	1.28	-	1.035
Anderson Darling Probability Test Value (Log-normal)			-	1.298	N/A	1.132	2.587	2.71	2.583	1.435	-	1.32

Data provided by Robert Pitt, University of Alabama

Table E1.4: Laundry Reference (“Library”) Samples, CONT.

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Renee's House (unknown)	11/3/2002	2	1.10	0.55	N/A	N/A	N/A	N/A
2	Renee's House (unknown)	12/14/2002	2	0.89	0.44	N/A	N/A	N/A	N/A
3	Renee's House (unknown)	5/11/2003	7	2.50	0.35	0.53	290.9	<1	<1
4	Renee's House (unknown)	5/11/2003	4	0.50	0.12	0.36	<1	<1	<1
5	Renee's House (unknown)	5/11/2003	15	0.53	0.03	0.67	<1	<1	<1
6	Yukio's apartment (Purex)	5/30/2003	15	1.50	0.1	0.75	>2419.2	>2419.2	<1
7	Yukio's apartment (Purex)	5/31/2003	9	5	0.55	0.58	>2419.2	20.1	<1
8	Suman (Tide)	5/30/2003	5	8	1.6	7.90	>2419.2	<1	<1
9	Yukio's apartment (Purex)	6/3/2003	12	3	0.25	0.97	>2419.2	19.7	<1
10	Soumya (Tide)	6/3/2003	2	5	2.5	10.80	<1	<1	<1
11	Veera (Gain)	6/3/2003	2	2	1	1.16	<1	<1	<1
12	Sanju (Tide)	6/8/2003	3	9	3	0.70	<1	<1	<1
Mean			6.5	3.2	0.87	2.4	>2419.2	-	<1
Standard Deviation			5.0	2.8	0.98	3.7	-	-	-
COV			0.78	0.89	1.12	1.59	-	-	-
Anderson Darling Probability Test Value (Normal)			1.568	1.468	1.871	3.419	-	-	-
Anderson Darling Probability Test Value (Log-normal)			1.294	0.982	0.99	2.106	-	-	-

Data provided by Robert Pitt, University of Alabama

Table E1.5: Sewage (Dry Weather) Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (μS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	Tuscaloosa WWTP (Dry Season)	12/18/2002	6.44	780	N/A	192	>100	0.64	36	10	N/A	260
2	Tuscaloosa WWTP (Dry Season)	1/8/2003	6.56	2100	N/A	306	>100	0.74	42	10	N/A	156
3	Tuscaloosa WWTP (Dry Season)	1/15/2003	6.42	1500	N/A	203	>100	0.64	52	12.5	N/A	142
4	Tuscaloosa WWTP (Dry Season)	3/11/2003	6.9	1280	N/A	53.6	>100	0.68	68	10	N/A	189
5	Tuscaloosa WWTP (Dry Season)	5/18/2003	7.1	540	N/A	230	70	0.65	65	8	114406	264
6	Tuscaloosa WWTP (Dry Season)	5/29/2003	6.99	1090	N/A	128	100	0.82	42	8	115847	267
Mean			6.73	1215	-	185	>100	0.695	50	9.7	115126	213
Standard Deviation			0.29	553	-	86	-	0.072	13	1.66	1018	57
COV			0.04	0.45	-	0.46	-	0.104	0.260	0.171	0.009	0.27
Anderson Darling Probability Test Value (Normal)			1.878	1.96	-	1.77	-	1.992	1.874	2.012	-	2.042
Anderson Darling Probability Test Value (Log-normal)			-	1.913	-	1.996	-	1.96	1.846	2	-	2.025

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Tuscaloosa WWTP (Dry Season)	12/18/2002	11	11	1	N/A	>2419.2	>2419.2	>2419.2
2	Tuscaloosa WWTP (Dry Season)	1/8/2003	10	14	1.4	N/A	N/A	N/A	N/A
3	Tuscaloosa WWTP (Dry Season)	1/15/2003	15	18	1.2	N/A	>2419.2	>2419.2	>2419.2
4	Tuscaloosa WWTP (Dry Season)	3/11/2003	11	45	4.0	N/A	>2419.2	816.4	43.6
5	Tuscaloosa WWTP (Dry Season)	5/18/2003	15	37.5	2.5	N/A	N/A	N/A	N/A
6	Tuscaloosa WWTP (Dry Season)	5/29/2003	9	27	3	0.97	>24192000	12033000	613000
Mean			11.8	25.4	2.19	0.97	>2419.2	6000000	300000
Standard Deviation			2.5	13.6	1.21	-	-	8500000	430000
COV			0.21	0.53	0.55	-	-	1.41	1.41
Anderson Darling Probability Test Value (Normal)			2.026	1.77	1.81	-	-	3.066	3.065
Anderson Darling Probability Test Value (Log-normal)			1.955	1.737	1.785	-	-	2.846	2.672

Data provided by Robert Pitt, University of Alabama

Table E1.6: Sewage (Wet Weather) Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (µS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	Tuscaloosa WWTP (Wet Season)	5/30/2003	6.8	1240	N/A	202	>100	0.19	52	8	115770	267
2	Tuscaloosa WWTP (Wet Season)	6/2/2003	6.81	1250	N/A	270	>100	0.22	48	7.5	126580	292
3	Tuscaloosa WWTP (Wet Season)	6/3/2003	6.99	440	N/A	255	100	0.25	44	6	108689	251
4	Tuscaloosa WWTP (Wet Season)	6/4/2003	6.92	440	N/A	231	100	0.14	52	8	129110	298
5	Tuscaloosa WWTP (Wet Season)	6/5/2003	7.00	550	N/A	113	57	0.20	54	7.5	109058	252
6	Tuscaloosa WWTP (Wet Season)	6/6/2003	7.00	850	N/A	259	60	0.17	47	7.5	105607	244
Mean			6.9	795	-	221	>79	0.19	49	7.4	115802	267
Standard Deviation			0.09	379	-	58	24	0.03	3.78	0.73	9932	22
COV			0.01	0.47	-	0.26	0.30	0.197	0.07	0.0996	0.086	0.086
Anderson Darling Probability Test Value (Normal)			2.097	1.722	-	2.097	2.72	1.708	1.83	2.357	-	1.911
Anderson Darling Probability Test Value (Log-normal)			-	1.725	-	2.3	2.706	1.734	1.838	2.43	-	1.898

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Tuscaloosa WWTP (Wet Season)	5/30/2003	11	30	2.72	1.38	>24192000	2851000	833000
2	Tuscaloosa WWTP (Wet Season)	6/2/2003	12	35	2.91	0.98	>24192000	3654000	598000
3	Tuscaloosa WWTP (Wet Season)	6/3/2003	12	22.5	1.87	0.93	>24192000	2187000	292000
4	Tuscaloosa WWTP (Wet Season)	6/4/2003	10	22.5	2.25	1.05	>24192000	1785000	328000
5	Tuscaloosa WWTP (Wet Season)	6/5/2003	11	36	3.27	1.01	>24192000	3255000	369000
6	Tuscaloosa WWTP (Wet Season)	6/6/2003	14	27.5	1.96	0.78	>24192000	2282000	609000
Mean			11.6	28.9	2.500	1.02	>24192000	2669000	504833
Standard Deviation			1.3	5.8	0.55	0.19	-	708561	210828
COV			0.11	0.203	0.22	0.195	-	0.265	0.418
Anderson Darling Probability Test Value (Normal)			1.891	1.809	1.751	1.984	-	1.744	1.854
Anderson Darling Probability Test Value (Log-normal)			1.858	1.825	1.761	1.906	-	1.747	1.833

Data provided by Robert Pitt, University of Alabama

Table E1.7: Industrial Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (µS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	DELPHI (Automotive manufacture)(Water supply unknown)	12/18/2002	6.72	240	N/A	91.6	20	0.04	23	7.5	N/A	722
2	PECO FOODS (Poultry Supplier) (City water supply)	12/18/2002	6.44	850	N/A	309	40	0.89	34	10	N/A	149
3	TAMKO (Roofing Products)(Water supply unknown)	12/18/2002	7	380	N/A	251	>100	0.02	32	12.5	N/A	309
4	DELPHI (Automotive manufacture)(Water supply unknown)	1/8/2003	6.88	340	N/A	225	10	LD	30	0.25	N/A	101
5	PECO FOODS (Poultry Supplier)(City water supply)	1/8/2003	6.22	960	N/A	14.8	10	0.72	32	0.5	N/A	130
6	TAMKO (Roofing Products)(Water supply unknown)	1/8/2003	6.9	310	N/A	210	>100	0.01	38	2	N/A	410
7	DELPHI (Automotive manufacture)(Water supply unknown)	1/15/2003	6.42	81	N/A	37.4	15	0.01	36	6	N/A	599
8	PECO FOODS (Poultry Supplier)(City water supply)	1/15/2003	6.36	45	N/A	10	20	0.81	28	5	N/A	150
9	TAMKO (Roofing Products)(Water supply unknown)	1/15/2003	7.3	37	N/A	226	>100	0.01	26	10	N/A	375
Mean			6.6	360	-	152	>19	0.31	31	5.9	-	327
Standard Deviation			0.35	335	-	114	11	0.41	4.7	4.4	-	221
COV			0.053	0.930	-	0.748	0.58	1.309	0.155	0.741	-	0.67
Anderson Darling Probability Test Value (Normal)			1.321	1.629	-	1.538	2.056	2.414	1.21	1.276	-	1.451
Anderson Darling Probability Test Value (Log-normal)			-	1.408	-	1.792	1.833	1.982	1.254	1.763	-	1.386

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	DELPHI (Automotive manufacture)(Water supply unknown)	12/18/2002	24	0.55	0.02	N/A	920.8	66.3	0
2	PECO FOODS (Poultry Supplier) (City water supply)	12/18/2002	37	6	0.16	N/A	>2419.2	>2419.2	>2419.2
3	TAMKO (Roofing Products)(Water supply unknown)	12/18/2002	8	10	1.25	N/A	>2419.2	3	>2419.2
4	DELPHI (Automotive manufacture)(Water supply unknown)	1/8/2003	92	0.4	0.004	N/A	N/A	N/A	N/A
5	PECO FOODS (Poultry Supplier)(City water supply)	1/8/2003	42	4.5	0.10	N/A	N/A	N/A	N/A
6	TAMKO (Roofing Products)(Water supply unknown)	1/8/2003	32	12	0.37	N/A	N/A	N/A	N/A
7	DELPHI (Automotive manufacture)(Water supply unknown)	1/15/2003	81	0.9	0.01	N/A	>2419.2	<1	<1
8	PECO FOODS (Poultry Supplier)(City water supply)	1/15/2003	45	2	0.04	N/A	>2419.2	>2419.2	866.4
9	TAMKO (Roofing Products)(Water supply unknown)	1/15/2003	37	8.5	0.22	N/A	204.6	<1	<1
Mean			44	4.9	0.24	-	>562	>34	>433.2
Standard Deviation			26.5	4.3	0.39	-	506	44	612
COV			0.60	0.88	1.6	-	0.89	1.2	1.4
Anderson Darling Probability Test Value (Normal)			1.611	1.371	2.499	-	2.575	2.668	2.172
Anderson Darling Probability Test Value (Log-normal)			1.536	1.436	1.203	-	2.603	1.963	2.467

Data provided by Robert Pitt, University of Alabama

Table E1.8: Industrial (Cintas) Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (µS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	CINTAS (Cooperate uniform mfg.)(City water supply)	12/18/2002	11.44	1460	N/A	3388	>100	<LD	35	5	N/A	29
2	CINTAS (Cooperate uniform mfg.)(City water supply)	1/8/2003	9.56	850	N/A	483	>100	<LD	40	10	N/A	285
3	CINTAS (Cooperate uniform mfg.)(City water supply)	1/15/2003	10.22	85	N/A	4023	>100	0.02	32	3	N/A	66
Mean			10.4	798	-	2631	>100	<0.02	35	6	-	127
Standard Deviation			0.95	688	-	1887	-	-	4.0	3.6	-	138
COV			0.091	0.86	-	0.71	-	-	0.11	0.6	-	1.08
Anderson Darling Probability Test Value (Normal)			3.067	3.072	-	3.21	-	-	3.063	3.084	-	3.15
Anderson Darling Probability Test Value (Log-normal)			-	3.201	-	3.298	-	-	3.06	3.059	-	3.067

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	CINTAS (Cooperate uniform mfg.)(City water supply)	12/18/2002	53	7.5	0.14	N/A	0	0	0
2	CINTAS (Cooperate uniform mfg.)(City water supply)	1/8/2003	56	6	0.10	N/A	N/A	N/A	N/A
3	CINTAS (Cooperate uniform mfg.)(City water supply)	1/15/2003	85	5	0.05	N/A	0	<1	22.2
Mean			64	6.1	0.10	-	0	-	11.1
Standard Deviation			17	1.2	0.04	-	0	-	15.6
COV			0.27	0.20	0.40	-	-	-	1.4
Anderson Darling Probability Test Value (Normal)			3.182	3.06	3.079	-	4.201	-	4.201
Anderson Darling Probability Test Value (Log-normal)			3.167	3.059	3.118	-	-	-	-

Data provided by Robert Pitt, University of Alabama

Table E1.9: Irrigation Reference (“Library”) Samples

Sample number	Sampling Location	Date	pH	Spec. cond. (μS/cm)	Temp. (°F)	Turb. (NTU)	Color (APHA Platinum Cobalt Units)	F (mg/L)	Hard. (mg/L CaCO ₃)	Detergent (mg/L as MBAS)	Fluorescence (raw signal strength)	Fluorescence (mg/L as “Tide”)
1	Ferguson Parking (UA) - Run over concrete	5/16/2003	7.91	200	N/A	16.2	0	0.69	62	0	21226	49
2	B.B. Commer (UA) - Run over concrete	5/18/2003	7.38		N/A	4.03	10	0.68	60	0	13915	32
3	Art Building (UA) - Taken at a little puddle, NO concrete	5/16/2003	7.46	200	N/A	64.6	0	0.76	55	0	40040	92
4	MIB (UA) - Run over concrete	5/19/2003	7.18	163	N/A	9.95	20	0.83	58	0	19234	44
5	MIB (UA) - Run over concrete	5/30/2003	7.1	148	89	21.8	50	0.30	40	0	26851	62
6	Art Building (UA) - Taken at a little puddle, NO concrete	5/30/2003	7.46	200	70	96.6	56	0.39	44	0	38389	88
7	Quad(UA) - Taken at a little puddle, NO concrete	5/30/2003	6.99	181	70	826	54	0.23	52	0	30820	53
8	MIB (UA) - Run over concrete	6/5/2003	7.26	183	82	14.5	50	0.64	54	0	23353	53
9	MIB (UA) - Taken at a little puddle, NO concrete	6/5/2003	7.16	182	78	16.5	30	0.91	52	0	17788	41
10	Bevil (UA) - Taken at a little puddle, NO concrete	6/5/2003	6.91	156	72	32	27	0.57	48	0	24149	55
11	MIB (UA) - Run over concrete	6/9/2003	7.4	183	78	9	40	0.84	66	0	23160	53
12	MIB (UA) - Taken at a little puddle, NO concrete	6/9/2003	7.3	194	80	16.6	50	0.57	54	0	23260	53
Mean			7.2	180	77	93	32	0.61	53	0	25182	56
Standard Deviation			0.26	18	6.5	232	20	0.21	7.3	0	7831	17
COV			0.03	0.10	0.08	2.46	0.64	0.35	0.13	-	0.31	0.31
Anderson Darling Probability Test Value (Normal)			1.147	1.401		5.099	1.296	1.103	1.002	-	-	1.718
Anderson Darling Probability Test Value (Log-normal)			-	1.457		1.516	1.677	1.457	1.006	-	-	1.383

Data provided by Robert Pitt, University of Alabama

Table E1.9: Irrigation Reference (“Library”) Samples, CONT.

Sample number	Sampling Location	Date	K (mg/L)	NH ₃ (mg/L as N)	NH ₃ /K (ratio)	B (mg/L)	Total Coliforms (MPN/100 mL)	<i>E. coli</i> (MPN/100 mL)	Enterococci (MPN/100 mL)
1	Ferguson Parking (UA) - Run over concrete	5/16/2003	2	<LD	N/A	0.14	>2419.2	27.8	>2419.2
2	B.B. Commer (UA) - Run over concrete	5/18/2003	9	1.0	0.111	0.20	>2419.2	8.3	2
3	Art Building (UA) - Taken at a little puddle, NO concrete	5/16/2003	5	0.08	0.016	0.25	>2419.2	>2419.2	>2419.2
4	MIB (UA) - Run over concrete	5/19/2003	3	0.21	0.07	0.13	>2419.2	>2419.2	>2419.2
5	MIB (UA) - Run over concrete	5/30/2003	2	3.5	1.75	0.2	>2419.2	31.8	>2419.2
6	Art Building (UA) -Taken at a little puddle, NO concrete	5/30/2003	4	0.5	0.125	0.36	>2419.2	>2419.2	287.7
7	Quad(UA) - Taken at a little puddle, NO concrete	5/30/2003	5	1	0.2	0.5	>2419.2	>2419.2	>2419.2
8	MIB (UA) - Run over concrete	6/5/2003	9	4.5	0.5	0.22	>2419.2	>2419.2	>2419.2
9	MIB (UA) - Taken at a little puddle, NO concrete	6/5/2003	8	0.5	0.06	0.14	>2419.2	>2419.2	>2419.2
10	Bevil (UA) - Taken at a little puddle, NO concrete	6/5/2003	4	1	0.25	0.23	>2419.2	1299.7	>2419.2
11	MIB (UA) - Run over concrete	6/9/2003	7	0.5	0.07	0.25	>4838.4	>4838.4	>4838.4
12	MIB (UA) - Taken at a little puddle, NO concrete	6/9/2003	10	1	0.1	0.35	>4838.4	>4838.4	>4838.4
Mean			5.6	1.25	0.29	0.24	>2419.2	>2419.2	>2419.2
Standard Deviation			2.8	1.41	0.50	0.10	-	-	-
COV			0.50	1.12	1.69	0.43	-	-	-
Anderson Darling Probability Test Value (Normal)			1.144	2.471	3.343	1.366	-	-	-
Anderson Darling Probability Test Value (Log-normal)			1.146	1.325	1.277	1.094	-	-	-

Data provided by Robert Pitt, University of Alabama

Appendix E-2. Data Tables for Birmingham

Table E2.1: Spring Water Samples													
Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (125) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	310	0.09	231	0	11	0.83	0.02	6.92	0	0.00	0	NA	NA
2	288	0.01	239	0	4	0.76	0.00	6.89	0	0.00	0	NA	NA
3	327	0.01	255	0	5	0.69	0.01	7.01	0	0.00	0	NA	NA
4	310	0.03	248	0	5	0.72	0.05	6.98	0	0.01	0	0	0
5	301	0.05	240	0	10	0.74	0.00	7.00	0	0.01	0	0	0
6	295	0.00	243	0	2	0.73	0.00	6.87	0	0.00	0	0	0
7	298	0.03	241	0	6	0.56	0.00	6.99	0	0.00	0	0	0
8	290	0.03	229	0	8	0.72	0.00	6.95	0	0.00	0	0	0
9	295	0.05	233	0	10	0.76	0.00	6.99	0	0.01	0	0	0
10	298	0.01	239	0	7	0.77	0.01	7.01	0	0.00	0	0	0
Mean	301	0.03	240	0	7	0.73	0.01	6.96	0	0.00	0	0	0
St. Dev.	11.6	0.03	7.83	0	2.9	0.07	0.02	0.05	0	0.00	0	0	0
95% conf limits (mean +/-)	6.87	0.02	4.63	0	1.7	0.04	0.01	0.03	0	0.00	0	0	0
Median	298	0.03	240	0	7	0.74	0.00	6.99	0	0.00	0	0	0
Coefficient of Variability	0.04	1.00	0.03	--	0.43	0.10	2.00	0.01	--	--	--	--	--
Distribution	normal	normal	normal	uniform	normal	normal	l-norm	normal	uniform	uniform	uniform	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.2: Shallow Ground Water Samples

Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	5	0.08	5	0	7	NA	NA	NA	5	0.04	0	0.01	0
2	5	0.03	22	0	12	NA	NA	NA	20	0.00	0	0.01	0
3	32	0.14	18	0	160	NA	NA	7.8	35	0.08	0	0.00	0
4	128	0.07	41	0	34	1.70	0.38	6.2	0	0.02	0	0.00	0
5	119	0.05	38	0	22	2.15	0.89	5.4	0	0.00	0	0.00	0
6	77	0.04	29	0	15	0.81	0.08	6.4	10	0.01	0	0.00	0
7	31	0.05	32	0	8	0.91	0.05	6.5	5	0.00	0	0.00	0
8	43	0.06	35	0	11	0.89	0.09	6.7	0	0.00	0	0.00	0
9	46	0.04	27	0	17	1.01	0.13	6.4	5	0.01	0	0.00	0
10	28	0.07	26	0	13	0.83	0.08	6.3	0	0.00	0	0.00	0
Mean	51	0.06	27	0	30	1.19	0.24	6.46	8	0.02	0	0.00	0
St. Dev.	43.3	0.03	10.5	0	46.4	0.53	0.31	0.66	11.4	0.03	0	0.00	0
95% conf limits (mean +/-)	34.6	0.03	8.48	0	37.1	0.42	0.25	0.53	9	0.02		0.00	0
Median	38	0.06	28	0	14	0.91	0.09	6.40	5	0.01	0	0.00	0
Coefficient of Variability	0.84	0.50	0.39	--	1.55	0.44	1.26	0.10	1.42	1.50	--	--	--
Distribution	normal	l-normal	normal	uniform	l-normal	normal	normal	normal	l-normal	normal	uniform	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.3: Samples from Irrigation of Landscaped Areas

Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	109	0.98	42.3	0	132.1	6.46	0.28	6.88	5	0.03	0.0	0.00	0.00
2	119	0.93	39.0	0	218.6	9.42	0.24	6.90	15	0.05	0.0	0.00	0.00
3	92	1.65	41.4	0	267.6	3.21	0.55	7.09	15	0.08	0.0	0.00	0.00
4	98	1.94	40.4	0	199.9	6.32	0.40	7.04	10	0.02	0.0	0.00	0.00
5	107	0.97	39.4	0	231.6	5.44	0.41	6.90	10	0.03	0.0	0.00	0.00
6	110	0.81	38.0	0	242.0	6.71	0.37	7.02	13	0.00	0.0	0.00	0.00
7	100	0.93	39.0	0	212.4	6.49	0.31	7.01	10	0.03	0.0	0.00	0.00
8	102	0.89	41.0	0	201.2	4.98	0.48	6.89	7	0.01	0.0	0.00	0.00
9	106	0.91	42.0	0	223.6	5.79	0.35	6.91	5	0.00	0.0	0.00	0.00
10	107	0.98	39.0	0	215.0	6.01	0.32	6.98	10	0.00	0.0	0.00	0.00
Mean	105	0.90	40.2	0	214.4	6.08	0.37	6.96	10	0.03	0.0	0.00	0.00
St. Dev.	7.28	0.10	1.47	0	35.20	1.56	0.09	0.08	3.62	0.03	0.00	0.00	0.00
95% conf. limits (mean +/-)	5.83	0.08	1.18	0	28.17	1.25	0.07	0.06	2.90	0.02	0.00	0.00	0.00
Median	106	0.93	39.9	0	216.80	6.17	0.36	6.95	10	0.03	0.0	0.00	0.00
Coefficient of Variability	0.07	0.11	0.04	--	0.16	0.26	0.25	0.01	0.36	1.00	--	--	--
Distribution	normal	normal	normal	uniform	normal	normal	normal	bi-modal	normal	normal	uniform	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.4: Residential/Commercial Sanitary Sewage Samples

Sample #	Collection Date	Collection Time	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)
1	1-Aug	10 p.m.	265	0.90	149	0.96	240	5.25
2	2-Aug	12 a.m.	320	0.72	161	3.80	200	4.79
3	2-Aug	2 a.m.	360	0.46	172	0.58	170	3.44
4	2-Aug	4 a.m.	350	0.58	181	0.54	155	3.09
5	2-Aug	6 a.m.	410	0.74	167	0.54	205	4.51
6	2-Aug	8 a.m.	435	0.87	154	0.99	265	5.88
7	2-Aug	10 a.m.	410	1.08	150	0.48	265	5.99
8	2-Aug	12 p.m.	400	0.77	145	3.60	270	5.70
9	2-Aug	2 p.m.	410	0.83	149	0.54	280	7.50
10	2-Aug	4 p.m.	460	0.93	151	0.95	265	7.20
11	2-Aug	6 p.m.	410	0.88	156	0.98	265	6.78
12	2-Aug	8 p.m.	430	0.88	158	0.96	300	7.56
13	4-Aug	6 p.m.	550	0.69	145	4.20	280	7.00
14	4-Aug	8 p.m.	460	0.64	133	4.40	280	6.73
15	4-Aug	10 p.m.	500	0.74	123	0.97	265	6.05
16	5-Aug	12 a.m.	420	0.60	142	0.99	227	4.03
17	5-Aug	2 a.m.	360	0.54	148	0.65	175	3.55
18	5-Aug	4 a.m.	365	0.43	158	0.64	120	4.94
19	5-Aug	6 a.m.	390	0.60	142	0.62	230	7.47
20	5-Aug	8 a.m.	500	1.04	126	0.65	310	7.13
21	5-Aug	10 a.m.	450	0.80	125	0.96	315	6.87
22	5-Aug	12 p.m.	430	0.97	126	0.98	310	6.88
23	5-Aug	2 p.m.	420	0.85	126	0.90	300	7.07
24	5-Aug	4 p.m.	460	0.83	122	0.94	290	7.55
25	6-Aug	6 p.m.	440	0.81	127	2.40	280	7.14
26	6-Aug	8 p.m.	435	0.66	123	1.60	290	6.75
27	6-Aug	10 p.m.	400	0.77	120	0.97	265	6.12
28	7-Aug	12 a.m.	390	0.67	133	0.96	210	5.06
29	7-Aug	2 a.m.	340	0.44	149	0.89	175	3.59
30	7-Aug	4 a.m.	400	0.43	141	0.76	170	3.57
31	7-Aug	6 a.m.	420	0.68	138	0.98	300	6.65
32	7-Aug	8 a.m.	465	1.04	136	0.95	260	5.68
33	7-Aug	10 a.m.	460	0.94	141	3.00	280	6.69
34	7-Aug	12 p.m.	460	0.89	138	3.60	285	6.93
35	7-Aug	2 p.m.	490	0.85	135	4.00	265	7.11
36	7-Aug	4 p.m.	450	0.83	155	2.00	270	6.69
Mean			420	0.76	143	1.50	251	5.97
St. Dev.			55.14	0.17	15.04	1.22	49.88	1.36
95% conf. limits (mean +/-)			18.01	0.06	4.91	0.40	16.33	0.45
Median			420	0.79	142	0.96	265	6.67
Coefficient of Variability			0.13	0.23	0.11	0.82	0.20	0.23
Distribution			normal	normal	normal	normal	normal	normal

Data provided by Robert Pitt, University of Alabama

Appendix E: Flow Type Data from Tuscaloosa and Birmingham, AL

Table E2.4 (cont.)									
Sample #	Collection Date	Collection Time	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	1-Aug	10 p.m.	8.59	7.35	42	0.01	23.8	0.01	0.00
2	2-Aug	12 a.m.	7.25	7.23	10	0.03	29.2	0.00	0.00
3	2-Aug	2 a.m.	5.02	7.33	12	0.03	30.3	0.00	0.00
4	2-Aug	4 a.m.	5.22	7.24	8	0.01	26.0	0.00	0.00
5	2-Aug	6 a.m.	13.04	7.35	11	0.02	16.3	0.00	0.00
6	2-Aug	8 a.m.	14.23	7.30	12	0.00	23.8	0.00	0.00
7	2-Aug	10 a.m.	13.03	7.17	15	0.01	20.6	0.01	0.00
8	2-Aug	12 p.m.	9.67	6.97	31	0.00	21.7	0.02	0.00
9	2-Aug	2 p.m.	8.00	6.98	28	0.00	15.3	0.00	0.00
10	2-Aug	4 p.m.	8.81	7.12	22	0.00	11.0	0.00	0.00
11	2-Aug	6 p.m.	7.82	7.03	23	0.00	17.4	0.00	0.00
12	2-Aug	8 p.m.	7.32	7.09	21	0.05	19.5	0.01	0.00
13	4-Aug	6 p.m.	10.03	7.21	75	0.00	43.3	NA	NA
14	4-Aug	8 p.m.	9.18	6.94	61	0.03	47.2	NA	NA
15	4-Aug	10 p.m.	11.82	7.10	45	0.00	41.7	NA	NA
16	5-Aug	12 a.m.	11.04	6.89	49	0.00	41.1	NA	NA
17	5-Aug	2 a.m.	6.38	7.10	26	0.02	46.7	NA	NA
18	5-Aug	4 a.m.	6.00	7.05	19	0.01	49.6	NA	NA
19	5-Aug	6 a.m.	12.83	7.16	22	0.00	52.2	NA	NA
20	5-Aug	8 a.m.	19.49	7.06	50	0.01	52.8	NA	NA
21	5-Aug	10 a.m.	12.34	6.88	60	0.00	37.8	NA	NA
22	5-Aug	12 p.m.	10.67	7.00	64	0.00	48.9	NA	NA
23	5-Aug	2 p.m.	8.57	6.98	54	0.01	47.8	NA	NA
24	5-Aug	4 p.m.	9.25	7.06	48	0.00	53.3	NA	NA
25	6-Aug	6 p.m.	11.00	7.03	62	0.02	65.4	NA	NA
26	6-Aug	8 p.m.	9.99	6.98	48	0.04	99.6	NA	NA
27	6-Aug	10 p.m.	10.66	7.01	43	0.10	99.4	NA	NA
28	7-Aug	12 a.m.	8.29	7.06	15	0.03	40.5	NA	NA
29	7-Aug	2 a.m.	5.53	7.13	16	0.00	4.2	NA	NA
30	7-Aug	4 a.m.	5.84	7.13	18	0.01	3.1	NA	NA
31	7-Aug	6 a.m.	17.28	7.16	42	0.02	54.0	NA	NA
32	7-Aug	8 a.m.	15.74	7.18	68	0.00	98.3	NA	NA
33	7-Aug	10 a.m.	10.99	7.03	80	0.00	68.6	NA	NA
34	7-Aug	12 p.m.	10.03	7.08	54	0.00	71.9	NA	NA
35	7-Aug	2 p.m.	7.43	6.86	52	0.01	69.7	NA	NA
36	7-Aug	4 p.m.	8.58	7.11	58	0.03	71.9	NA	NA
Mean			9.92	7.09	38	0.01	43.4	0.00	0.00
St. Dev.			3.33	0.13	20.95	0.02	25.47	0.01	0.00
95% Conf. limits (mean +/-)			1.09	0.04	6.84	0.01	8.32	0.00	0.00
Median			9.46	7.09	42	0.01	42.5	0.00	0.00
Coefficient of Variability			0.34	0.02	0.55	2.00	0.59	--	--
Distribution			L-normal	normal	normal	L-normal	normal	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.5: Residential Septic Tank Discharge Samples

Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH (units)	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	82	0.75	252	0.03	511	30.06	117.80	7.23	38	0.03	100	NA	NA
2	108	0.70	186	0.00	547	32.06	124.60	7.38	38	0.01	100	NA	NA
3	56	0.62	186	0.00	536	27.26	114.40	7.16	18	0.00	100	NA	NA
4	397	1.19	36	10.00	266	8.16	26.07	6.61	68	0.01	100	NA	NA
5	482	0.70	29	5.00	321	8.83	135.75	6.53	87	0.03	100	NA	NA
6	362	1.12	36	12.00	351	8.16	26.77	6.67	77	0.00	100	NA	NA
7	812	0.92	80	0.50	466	20.85	89.60	6.63	54	0.00	100	NA	NA
8	812	1.55	84	0.15	431	23.25	91.60	6.59	64	0.01	100	NA	NA
9	762	1.26	82	0.57	471	22.25	86.10	6.54	91	0.03	100	NA	NA
10	432	0.61	45	2.50	455	24.51	95.90	7.39	55	0.20	100	0.00	0.00
11	297	0.42	53	1.00	253	18.66	107.80	6.19	10	0.00	100	0.00	0.00
12	236	0.56	61	0.50	463	21.73	99.30	6.59	100	0.19	100	0.40	0.00
13	327	0.87	63	0.45	339	31.81	113.20	6.72	100	0.20	100	0.35	0.00
Mean	502	0.93	57	3.27	382	18.82	87.21	6.65	70.60	0.07	100	0.19	0.00
St. Dev.	209.87	0.36	20.52	4.35	84.95	7.97	35.11	0.30	27.28	0.09	0.00	0.22	0.00
95% conf. limits (mean +/-)	114.09	0.20	11.16	2.37	46.18	4.33	19.09	0.16	14.83	0.05	0.00	0.12	0.00
Median	414	0.90	57	0.79	391	21.29	93.75	6.60	72.50	0.02	100	0.18	0.00
Coefficient of Variability	0.42	0.39	0.36	1.33	0.22	0.42	0.40	0.04	0.39	1.28	0.00	1.16	--
Distribution	normal	normal	log-normal	log-normal	normal	normal	normal	normal	normal	normal	uniform	bi-modal	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.6: Commercial Carwash Samples

Sample #	Conductivity ($\mu\text{S/cm}$)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO_3)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	448	16.5	145	50.4	1325	22.00	0.28	6.49	380	0.00	100	0.00	0.00
2	450	11.5	149	52.2	1350	22.00	0.32	6.46	340	0.00	100	0.00	0.00
3	550	12.5	152	52.5	1400	78.40	0.20	7.11	190	0.00	100	0.00	0.00
4	490	15.5	150	49.0	1100	40.70	0.23	6.90	190	0.01	100	0.00	0.00
5	495	12.5	158	56.7	1075	47.70	0.19	6.84	190	0.00	100	0.00	0.00
6	470	8.0	160	50.3	1095	35.40	0.14	6.77	240	0.02	100	0.00	0.00
7	480	10.2	172	38.0	1005	48.20	0.23	6.76	200	0.08	100	NA	NA
8	473	11.8	165	49.0	1155	46.20	0.25	6.67	175	0.23	100	NA	NA
9	492	12.3	159	43.5	1190	16.70	0.19	6.40	160	0.12	100	0.00	0.00
10	505	12.2	155	48.0	1205	39.60	0.36	6.80	150	0.15	100	0.00	0.00
Mean	485	12.3	157	49.0	1190	42.69	0.24	6.72	222	0.07	100	0.00	0.00
St. Dev.	9.41	2.40	8.07	5.14	130.79	15.92	0.07	0.22	77.46	0.08	0.00	0.00	0.00
95% conf. limits (mean +/-)	8.23	1.49	5.00	3.19	81.06	9.87	0.04	0.14	48.01	0.05	0.00	0.00	0.00
Median	485	12.3	157	49.7	1173	43.45	0.23	6.77	190	0.05	100	0.00	0.00
Coefficient of Variability	0.06	0.19	0.05	0.10	0.11	0.37	0.28	0.03	0.35	1.14	0.00	--	--
Distribution	normal	normal	normal	normal	normal	normal	normal	normal	normal	bi-modal	uniform	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.7: Commercial Laundry Samples													
Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	752	15.89	32	37.0	1169.6	3.47	0.94	9.37	25	0.57	100	NA	NA
2	462	23.98	40	21.5	1144.6	3.97	0.96	9.40	59	0.51	100	NA	NA
3	422	54.48	38	17.0	844.6	3.37	0.62	8.37	61	0.44	100	NA	NA
4	589	42.48	36	32.5	819.6	3.67	0.70	8.60	43	0.38	100	NA	NA
5	657	48.98	34	35.0	1169.6	3.57	0.84	9.10	49	0.21	100	NA	NA
6	565	31.48	37	31.0	1094.6	3.27	0.91	9.20	30	0.33	100	NA	NA
7	485	22.48	38	20.0	994.6	3.77	0.78	9.41	55	0.42	100	NA	NA
8	715	26.98	33	25.0	1019.6	2.57	0.88	9.05	38	0.47	100	0.00	0.00
9	545	35.98	32	24.0	1019.6	3.67	0.69	9.36	57	0.33	100	0.00	0.00
10	437	25.48	37	26.0	969.9	3.47	0.84	9.12	50	0.35	100	0.00	0.00
Mean	563	32.82	36	26.9	1024.6	3.48	0.82	9.10	47	0.40	100	0.00	0.00
St. Dev.	115.81	12.45	2.78	6.69	124.61	0.38	0.12	0.35	12.41	0.10	0.00	0.00	0.00
95% conf. limits (mean +/-)	68.44	7.36	1.64	3.96	73.64	0.22	0.07	0.21	7.33	0.06	0.00	0.00	0.00
Median	555	29.23	37	25.5	1019.6	3.52	0.84	9.16	50	0.40	100	0.00	0.00
Coefficient of Variability	0.21	0.38	0.08	0.25	0.12	0.11	0.14	0.04	0.27	0.26	0.00	--	--
Distribution	normal	normal	normal	normal	normal	normal	normal	normal	normal	normal	uniform	uniform	uniform

Data provided by Robert Pitt, University of Alabama

NA: Data not available

Table E2.8: Radiator Waste Samples

Sample #	Conductivity ($\mu\text{S}/\text{cm}$)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO_3)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	4250	136.5	0	17.4	20850	3230	16.9	6.95	2933	0.04	100	NA	NA
2	3350	177.0	0	13.8	24000	2446	32.4	6.99	3000	0.02	100	NA	NA
3	4200	172.5	32	14.7	20500	3473	21.0	6.25	3066	0.06	100	NA	NA
4	3321	133.3	12	14.2	21940	2694	18.1	7.01	3000	0.03	100	NA	NA
5	3289	129.8	0	15.1	22210	2902	22.3	6.85	3000	0.04	100	NA	NA
6	3510	121.5	12	18.3	22240	2907	12.2	6.50	3000	0.00	100	NA	NA
7	1900	183.0	0	13.5	22650	2282	8.9	7.61	2933	0.03	100	NA	NA
8	2510	124.5	0	13.5	22250	2364	90.1	7.38	3000	0.03	100	NA	NA
9	2987	170.1	0	14.6	21920	2899	23.8	6.98	3066	0.02	100	NA	NA
10	3466	145.0	0	15.3	21900	2821	17.5	7.11	3000	0.03	100	NA	NA
Mean	3278	149.3	5.6	15.04	22046	2801	26.3	6.96	3000	0.03	100	NA	NA
St. Dev.	704.32	23.76	10.53	1.62	952.08	374.89	23.32	0.39	44.33	0.02	0.00	NA	NA
95% conf. limits (mean +/-)	436.54	14.73	6.53	1.00	590.10	323.36	14.45	0.24	27.48	0.01	0.00	NA	NA
Median	3335	140.8	0	14.65	22075	2864	24.5	6.99	3000	0.03	100	NA	NA
Coefficient of Variability	0.21	0.16	1.88	0.11	0.04	0.13	0.89	0.06	0.01	0.52	0.00	NA	NA
Distribution	normal	normal	normal	normal	normal	normal	normal	normal	normal	normal	uniform	NA	NA
<i>Data provided by Robert Pitt, University of Alabama</i>													

NA: Data not available

Table E2.9: Plating Bath Waste Samples

Sample #	Conductivity (µS/cm)	Fluoride (mg/L)	Hardness (mg/L) (as CaCO ₃)	Detergent (mg/L)	Fluoresc. (% scale)	Potassium (mg/L)	Ammonia (mg/L)	pH	Color (units)	Chlorine (mg/L)	Toxicity (I25) (% reduc.)	Copper (mg/L)	Phenols (mg/L)
1	16200	9.00	1408	15.0	640.0	774	105.00	1.78	60	0.12	100	0.27	0
2	3620	1.68	950	1.8	505.0	552	74.20	4.82	90	0.27	100	0.00	0
3	8500	1.86	775	10.0	77.5	1730	3.05	5.20	368	0.01	89.4	0.00	0
4	9700	6.00	1452	9.0	225.0	186	139.37	6.15	70	0.08	100	0.21	0
5	10200	5.52	1476	11.4	390.0	220	29.33	3.36	90	0.00	100	0.32	0
6	7000	5.85	1818	1.5	88.0	490	76.00	8.60	50	0.04	68.4	0.07	0
7	8000	6.00	2433	1.6	75.0	356	58.60	7.60	50	0.03	90.5	0.05	0
8	12500	7.95	1484	6.9	510.5	380	60.90	3.10	75	0.02	100	0.35	0
9	8100	4.20	1398	3.9	147.5	1100	101.00	2.50	110	0.00	100	0.48	0
10	19700	3.20	1091	7.0	275.0	4300	9.05	6.20	75	0.19	100	0.00	0
Mean	10352	5.13	1429	6.8	293.4	1009	65.65	4.93	104	0.08	94.8	0.18	0.00
St. Dev.	4681.35	2.41	464.03	4.63	206.61	1247.85	43.37	2.25	94.71	0.09	10.15	0.17	0.00
95% conf. limits (mean +/-)	2901.53	1.49	287.61	2.87	128.06	773.42	26.88	1.39	58.70	0.06	6.29	0.11	0.00
Median	9100	5.69	1430	6.9	250.0	521	67.55	5.01	75	0.04	100	0.14	0.00
Coefficient of Variability	0.45	0.47	0.32	0.68	0.70	1.24	0.66	0.46	0.91	1.20	0.11	0.94	--
Distribution	normal	normal	normal	normal	normal	log-normal	normal	normal	normal	normal	bi-modal	uniform	uniform

Data provided by Robert Pitt, University of Alabama

APPENDIX F

ANALYTICAL PROCEDURES FOR OUTFALL MONITORING

APPENDIX F1: INDICATOR PARAMETER OVERVIEW

Ammonia

Ammonia is a good indicator of sewage, since its concentration is much higher there than in groundwater or tap water. High ammonia concentrations may also indicate liquid wastes from some industrial sites. Ammonia is relatively simple and safe to analyze. Some challenges include the tendency for ammonia to volatilize (i.e., turn into a gas and become non-conservative) and its potential generation from non-human sources, such as pets or wildlife.

Boron

Boron is an element present in the compound borax, which is often found in detergent and soap formulations. Consequently, boron is a good potential indicator for both laundry wash water and sewage. Preliminary research from Alabama supports this contention, particularly when it is combined with other detergent indicators, such as surfactants (Pitt, IDDE Project Support Material). Boron may not be a useful indicator everywhere in the country since it may be found at elevated levels in groundwater in some regions and is a common ingredient in water softeners products. Program managers should collect data on boron concentrations in local tap water and groundwater sources to confirm whether it will be an effective indicator of illicit discharges.

Chlorine

Chlorine is used throughout the country to disinfect tap water, except where private wells provide the water supply. Chlorine concentrations in tap water tend to be significantly higher than most other discharge types. Unfortunately, chlorine is extremely volatile, and even moderate levels of organic materials can cause chlorine

levels to drop below detection levels. Because chlorine is non-conservative, it is not a reliable indicator, although if very high chlorine levels are measured, it is a strong indication of a water line break, swimming pool discharge, or industrial discharge from a chlorine bleaching process.

Color

Color is a numeric computation of the color observed in a water quality sample, as measured in cobalt-platinum units (APHA, 1998). Both industrial liquid wastes and sewage tend to have elevated color values. Unfortunately, some “clean” flow types can also have high color values. Field testing by Pitt (IDDE Project Support Material) found high color values associated for all contaminated flows, but also many uncontaminated flows, which yielded numerous false positives. Overall, color may be a good first screen for problem outfalls, but needs to be supplemented by other indicator parameters.

Conductivity

Conductivity, or specific conductance, is a measure of how easily electricity can flow through a water sample. Conductivity is often strongly correlated with the total amount of dissolved material in water, known as Total Dissolved Solids. The utility of conductivity as an indicator depends on whether concentrations are elevated in “natural” or clean waters. In particular, conductivity is a poor indicator of illicit discharge in estuarine waters or in northern regions where deicing salts are used (both have high conductivity readings).

Field testing in Alabama suggests that conductivity has limited value to detect sewage or wash water (Pitt, IDDE Project Support Material). Conductivity has some

value in detecting industrial discharges that can exhibit extremely high conductivity readings. Conductivity is extremely easy to measure with field probes, so it has the potential to be a useful supplemental indicator in subwatersheds that are dominated by industrial land uses.

Detergents

Most illicit discharges have elevated concentration of detergents. Sewage and washwater discharges contain detergents used to clean clothes or dishes, whereas liquid wastes contain detergents from industrial or commercial cleansers. The nearly universal presence of detergents in illicit discharges, combined with their absence in natural waters or tap water, makes them an excellent indicator. Research has revealed three indicator parameters that measure the level of detergent or its components-- surfactants, fluorescence, and surface tension (Pitt, IDDE Project Support Material). Surfactants have been the most widely applied and transferable of the three indicators. Fluorescence and surface tension show promise, but only limited field testing has been performed on these more experimental parameters. Methods and laboratory protocols for each of the three detergent indicator parameters are reviewed in Appendix F2.

***E. coli*, Enterococci and Total Coliform**

Each of these bacteria is found at very high concentrations in sewage compared to other flow types, and is a good indicator of sewage or septage discharges, unless pet or wildlife sources exist in the subwatershed. Overall, bacteria are good supplemental indicators and can be used to find “problem” streams or outfalls that exceed public health standards. Relatively simple analytical methods are now available to test for bacteria indicators, although they still suffer

from two monitoring constraints. The first is the relatively long analysis time (18-24 hours) to get results, and the second is that the waste produced by the tests may be classified as a biohazard and require special disposal techniques.

Fluorescence

Laundry detergents are highly fluorescent because optical brighteners are added to the formula to produce “brighter whites.” Optical brighteners are the reason that white clothes appear to have a bluish color when placed under a fluorescent light. Fluorescence is a very sensitive indicator of the presence of detergents in discharges, using a fluorometer to measure fluorescence at specific wavelengths of light. Since no chemicals are needed for testing, fluorometers have minimal safety and waste disposal concerns.

Some technical concerns do limit the utility of fluorescence as an indicator of illicit discharges. The concerns include the presence of fluorescence in non-illicit flow types such as irrigation water, the considerable variation of fluorescence between different detergent brands, and the lack of a readily standard or benchmark concentration for optical brighteners. For example, Pitt (IDDE Project Support Material) measured fluorescence in mg/L of TideTM brand detergent, and found the degree of fluorescence varied regionally, temporally, and between specific detergent formulations.

Given these current limitations, fluorescence is best combined with other detergent indicators such as surfactants. Appendix F3 should be consulted for more detailed information on analytical methods and experimental field testing using fluorescence as an indicator parameter.

Fluoride

Fluoride is added to drinking water supplies in most communities to improve dental health, and normally found at a concentration of two parts per million in tapwater. Consequently, fluoride is an excellent conservative indicator of tap water discharges or leaks from water supply pipes that end up in the storm drain. Fluoride is obviously not a good indicator in communities that do not fluoridate drinking water, or where individual wells provide drinking water. One key constraint is that the reagent used in the recommended analytical method for fluoride is considered a hazardous waste, and must be disposed of properly.

Hardness

Hardness measures the positive ions dissolved in water and primarily include magnesium and calcium in natural waters, but are sometimes influenced by other metals. Field testing by Pitt (IDDE Project Support Material) suggests that hardness has limited value as an indicator parameter, except when values are extremely high or low (which may signal the presence of some liquid wastes). Hardness may be applicable in communities where hardness levels are elevated in groundwater due to karst or limestone terrain. In these regions, hardness can help distinguish natural groundwater flows present in outfalls from tap water and other flow types.

pH

Most discharge flow types are neutral, having a pH value around 7, although groundwater concentrations can be somewhat variable. pH is a reasonably good indicator for liquid wastes from industries, which can have very high or low pH

(ranging from 3 to 12). The pH of residential wash water tends to be rather basic (pH of 8 or 9). The pH of a discharge is very simple to monitor in the field with low cost test strips or probes. Although pH data is often not conclusive by itself, it can identify problem outfalls that merit follow-up investigations using more effective indicators.

Potassium

Potassium is found at relatively high concentrations in sewage, and extremely high concentrations in many industrial process waters. Consequently, potassium can act as a good first screen for industrial wastes, and can also be used in combination with ammonia to distinguish wash waters from sanitary wastes. (See Chapter 12). Simple field probes can detect potassium at relatively high concentrations (5 mg/L), whereas more complex colorimetric tests are needed to detect potassium concentrations lower than 5 mg/L.

Surface Tension

Surfactants remove dirt particles by reducing the surface tension of the bubbles formed in laundry water when it is agitated. Reduced surface tension makes dirt particles less likely to settle on a solid surface (e.g., clothes or dishes) and become suspended instead on the water's surface. The visible manifestation of reduced surface tension is the formation of foam or bubbles on the water surface. Pitt (IDDE Project Support Material) tested a very simple procedure to measure surface tension that quantifies the formation of foam and bubbles in sample bottles. Initial laboratory tests suggest that surface tension is a good indicator of surfactants, but only when they are present at relatively high concentrations. Section F3 provides a more detailed description of the surface tension measurement procedure.

Surfactants

Surfactants are the active ingredient in most commercial detergents, and are typically measured as Methyl Blue Active Substances (or MBAS). They are a synthetic replacement for soap, which builds up deposits on clothing over time. Since surfactants are not found in nature, but are always present in detergents, they are excellent indicators of sewage and wash waters. The presence of surfactants in cleansers, emulsifiers and lubricants also makes them an excellent indicator of industrial or commercial liquid wastes. In fact, research by Pitt (IDDE Project Support Material) found that detergents were an excellent indicator of “contaminated” discharges in Alabama (i.e., discharges that were not tap water or groundwater). Several analytical methods are available to monitor surfactants. Unfortunately, the reagents used involve toluene, chloroform, or benzene, each of which is considered hazardous waste with a potential human health risk. The most common analysis method uses chloroform as a reagent, and is recommended because it is relatively safer when compared to other reagents.

Turbidity

Turbidity is a quantitative measure of cloudiness in water, and is normally measured with a simple field probe. While turbidity itself cannot always distinguish between contaminated flow types, it is a potentially useful screening indicator to determine if the discharge is contaminated (i.e., not composed of tap water or groundwater).

Research Indicators

In recent years, researchers have explored a series of other indicators to identify illicit discharges, including fecal steroids (such as coprostanol), caffeine, specific fragrances associated with detergents and stable isotopes of oxygen. Each of these research indicators is profiled in Pitt (IDDE Project Support Material) and summarized below in Table F1. Most research indicators require sophisticated equipment and specific expertise that limit their utility as a general indicator, given the high sampling cost and long turn-around times needed. To date, field tests of research indicators have yielded mixed results, and they are currently thought to be more appropriate for special research projects than for routine outfall testing. While they are not discussed further in this manual, future research and testing may improve their utility as indicators of illicit discharges.

Table F1: Summary of Research Indicators Used for Identifying Inappropriate Discharges into Storm Drainage		
Parameter Group	Comments	Recommendation
Coprostanol and other fecal sterol compounds	Used to indicate presence of sanitary sewage	Possibly useful. Expensive analysis with GC/MSD. Not specific to human wastes or recent contamination. Most useful when analyzing particulate fractions of wastewaters or sediments.
Specific detergent compounds (LAS, fabric whiteners, and perfumes)	Used to indicate presence of sanitary sewage	Possibly useful. Expensive analyses with HPLC. A good and sensitive confirmatory method.
Pharmaceuticals (colfibric acid, aspirin, ibuprofen, steroids, illegal drugs, etc.)	Used to indicate presence of sanitary sewage	Possibly useful. Expensive analyses with HPLC. A good and sensitive confirmatory method.
Caffeine	Used to indicate presence of sanitary sewage	Not very useful. Expensive analyses with GC/MSD. Numerous false negatives, as typical analytical methods not suitably sensitive.
DNA profiling of microorganisms	Used to identify sources of microorganisms	Likely useful, but currently requires extensive background information on likely sources in drainage. Could be very useful if method can be simplified, but with less specific results.
UV absorbance at 228 nm	Used to identify presence of sanitary sewage	Possibly useful, if UV spectrophotometer available. Simple and direct analyses. Sensitive to varying levels of sanitary sewage, but may not be useful with dilute solutions. Further testing needed to investigate sensitivity in field trials.
Stable isotopes of oxygen	Used to identify major sources of water	May be useful in area having distant domestic water sources and distant groundwater recharge areas. Expensive and time consuming procedure. Can not distinguish between wastewaters if all have common source.
GC/MSD - Gas Chromatography/Mass Selective Detector HPLC - High Performance Liquid Chromatography		

Appendix F2: “Off-the Shelf” Analytical Methodologies

F2.1 AMMONIA (0 TO 0.50 MG/L NH₃-N)

Equipment/Supplies Needed

- Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- ammonia nitrogen reagent set for 25-mL samples
- ammonia nitrogen standard solution

Procedure

Refer to Hach method 8155 for Nitrogen, Ammonia Salicylate Method (0 to 0.50 mg/L NH₃-N) for a 25mL sample. In this method, ammonia compounds combine with chlorine to form monochloramine. Monochloramine reacts with salicylate to form 5-aminosalicylate. The 5-aminosalicylate is oxidized in the presence of sodium nitroprusside catalyst to form a blue-colored compound. The blue color is masked by the yellow color from the excess reagent present to give a final green-colored solution.

Duration of Test for Each Sample

Because of the duration of this test, samples should be run in batches of about six. From start to finish, each batch of six samples takes about 25 minutes, including the time taken to clean the sample cells and reset the instrument between each batch.

Hazardous Reagents

According to good laboratory practice, the contents of each sample cell, after the analysis, should be poured into another properly-labeled container for proper disposal.

Ease of Analysis

This procedure is time-consuming and should be performed indoors.

Ordering Information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

[Note: The direct-Nessler method may be preferred due to its faster reaction times, but Nessler reagent is toxic and corrosive. Nessler reagent, according to its MSDS, causes severe burns, is an acute and a cumulative poison, and is a teratogen. It also contains from 5 to 10% mercuric iodide. It is now recommended that the more sensitive salicylate method because of the lower concentrations experienced in this research, and because of its lower toxicity and easier disposal requirements. The salicylate method was therefore used for this project, although prior research found it to be somewhat less satisfactory than the Nessler method.]

Equipment/Supplies Needed for Ammonia Analysis		
Item (Catalog Number)	Quantity	Price
<i>One of the colorimeters, or spectrophotometers, listed previously will be needed. Alternatively, a dedicated colorimeter can be used, but that will only be useable for a single analyte.</i>		
Ammonia-Nitrogen Reagent Set (25mL test) salicylate method (2243700)	1 set of 100 tests	\$180.56
Ammonia cyanurate reagent powder pillows (2395566)	1 pk of 50 pillows	\$ 20.20
Ammonia salicylate reagent powder pillows (2395366)	1 pk of 50 pillows	\$ 25.55

F2.2 BORON (Low range 0 to 1.50 mg/L as B)

Equipment/Supplies Needed

- A Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- Boron test kit
- 1-inch plastic sample cells (at least 2).

Procedure

Refer to Hach Azomethine-H Method 10061, which is adapted from ISO method 9390. In this procedure, Azomethine-H, a Schiff base, is formed by the condensation of an aminonaphthol with an aldehyde by the catalytic action of boron. The boron concentration in the sample is proportional to the developed color. Follow the Hach instructions that come with the reagent set for the specific procedure.

Duration of Test for Each Sample

Each batch of six samples takes approximately 20 minutes.

Hazardous Reagents

Standard laboratory practice requires that all unwanted chemicals be properly disposed.

Ease of Analysis

The procedure is a little time consuming, but several samples can be analyzed together.

Ordering information

Vendor: Hach Company
 PO Box 389
 Loveland, CO 80539-0389
 Tel: 800-227-4224
 Fax: 970-669-2932
 Website: www.hach.com

Equipment/Supplies Needed for Boron Analysis		
Item (Catalog Number)	Quantity	Price*
Boron Test Kit (0-1.5 mg/L) BoroTrace (Azomethine-H) Method (2666900)	1 set of 100 tests	\$50.00
BoroTrace 2 reagent (2666669)	1 pk of 100 pillows	\$30.00
BoroTrace 3 reagent (2666799)	1 pk of 100 pillows	\$20.65
EDTA Solution 1M (2241925)	50 mL	
DR/890 portable colorimeter Programmed with 90 tests. Includes 2 sample cells, COD & TnT tube adapter, instrument, procedure manual and batteries. Portable instrument that can be used for many different analytes, but fewer than the following instruments. (48470000) ¹	1	\$929.00
DR/2500 spectrophotometer includes 6 one-inch round sample cells, instrument and procedure manual, and DR/Check Absorbance Standards. Compact laboratory instrument having many capabilities. (5900000) ¹	1	\$2200.00
DR/2400 portable spectrophotometer includes one-inch sample cells, instrument and procedures manuals. Portable instrument having many capabilities. (5940000) ¹	1	\$1,995.00
DR/4000 V Spectrophotometer. Visible spectrum only (320 to 1100nm). Includes 1-inch matched sample cells/ AccuVacc and 16-mm vial adapters; a Single Cell Module; 1-inch and 1-cm cell adapters; dust cover; replacement lamp kit; an illustrated manual set; and a power cord. UV-Vis laboratory instrument having vast capabilities. (48100-00) ¹	1	\$5500.00
¹ Only one spectrophotometer is needed		
*The per-sample expendable cost is therefore about \$2.00.		

F2.3 COLOR (0 – 100 APHA Platinum Cobalt Units)

Equipment/Supplies needed

One Hach color test kit Model CO-1 which measures color using a color disc for comparison.

Procedure

The following procedure is described in the test kit.

Low Range

1. Place the lengthwise viewing adapter in the comparator.
2. fill one sample tube to the line underlining “Cat. 1730-00” with the sample. This will be approximately 15mL. If not using 1730-00 tubes, fill to the line found at approximately 3 inches up from the bottom of the tube.
3. Place the tube containing the water sample into the comparator in the right-hand position.
4. Fill the other sample tube with colorless water to the line underlining “Cat. 1730-00.” Insert this tube in the left-side comparator opening.
5. Hold the comparator with the tube tops pointing to a window or light source at approximately a 45 degree angle (with the light coming in through the top of the tubes). View through the openings in the front of the comparator. When viewing, use care to not spill samples from unstoppered tubes.

6. Rotate the disc until a color match is obtained. The reading obtained through the scale window is the apparent color in APHA Platinum Cobalt Units.

High Range

1. If the lengthwise viewing adapter is in place, remove it.
2. Fill one of the tubes to the 5mL mark with the water sample.
3. Insert the tube in the right top opening of the comparator.
4. Fill the other tube to the 5mL mark with clear water and insert this tube into the left opening of the comparator.
5. Hold the comparator up to a light source as explained above. The reading obtained through the scale window is multiplied by 5 to obtain the apparent color.

Duration of Test for Each Sample

One minute

Hazardous Reagents

None.

Ease of Analysis

This procedure easy and fast and can be performed outside of the laboratory.

Ordering Information

Vendor: Hach Company
 PO Box 389
 Loveland, CO 80539-0389
 Tel: 800-227-4224
 Fax: 970-669-2932
 Website: www.hach.com

Equipment/Supplies Needed for Color Analysis		
Item (Catalog Number)	Quantity	Price
Color Test Kit (0-100 mg/L) (223400)	one kit	\$51.50

F2.4 CONDUCTIVITY

Equipment/Supplies Needed

- Cardy pocket-sized conductivity meter model B-173 made by Horiba
- Conductivity standard that comes with the meter.

Calibration

Before any measurements can be performed the instrument must first be calibrated. The meter should hold its calibration for an extended period, but it is best to check the calibration before each sample batch.

1. Press the POWER button.
2. Place a drop of the 1.41 $\mu\text{S}/\text{cm}$ standard solution onto the sensor cell.
3. Press the CAL/MODE button to display the CAL mark and 1.41. Calibration is complete when the CAL mark disappears.
4. Wash the sensor with tap water, and dry with a tissue.

Measurement

1. Check first to see which mode the instrument is in by looking for the arrow pointing at the mS/cm or $\mu\text{S}/\text{cm}$.
2. Add a drop of the sample onto the sensor cell using a pipette (or the sensor may be immersed into the sample).
3. When the smiley face ☺ appears, take a reading. Be sure to note the units.

Duration of Test for Each Sample

1 minute

Hazardous Reagents

None

Ease of Analysis

Simple and fast. Can be used in the field.

Ordering Information

Vendor: Cole-Parmer Instrument Company
625 East bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

Equipment/Supplies Needed for Conductivity Analysis	
Item (Catalog Number)	Price
Cardy pocket-sized conductivity meter and accessories (EW-05751-10)	\$269.00
Replacement cardy conductivity sensor cartridge (EW-05751-52)	\$ 82.00
Replacement cardy conductivity solution kit (EW-05751-70)	\$ 43.00

F2.5 DETERGENTS (0-3 ppm)

Equipment/Supplies needed

- Detergents (anionic surfactants) kit from *CHEMetrics*.

Procedure

The following procedure comes with the Detergents kit. The Detergents CHEMetrics® test employs the methylene blue extraction method. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of “methylene blue active substances (MBAS)” in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in mg/L linear alkylbenzene sulfonate.

1. Rinse the reaction tube with sample, and then fill it to the 5 mL mark with sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip-breaking tool.
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube.
4. Cap the reaction tube and shake it vigorously for 30 seconds. Allow the tube to stand undisturbed for approximately 1 minute.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against

the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer).

7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Invert the ampoule several times, allowing the bubble to travel from end to end each time.
9. Using a tissue, remove the tubing from the ampoule tip. Wipe all liquid from the exterior of the ampoule, then place a small white cap firmly onto the tip of the ampoule.
10. Place the CHEMet ampoule, flat end downward into the center tube of the comparator. Direct the top of the comparator up toward a source of bright light while viewing from the bottom. Rotate the comparator until the color standard below the CHEMet ampoule shows the closest match. If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

Duration of Test for Each Sample

Approximately 7 minutes per sample.

Hazardous Reagents

The main components of the double-tipped ampoule are considered hazardous, and possibly carcinogenic (contains chloroform). The used ampoule should be placed back in the test kit box for later disposal at a hazardous waste facility. Use proper safety protection when performing this test: laboratory coat, gloves, and safety glasses. It is also strongly recommended that the test be performed under a laboratory fume hood. Wash hands thoroughly after handling the kit.

Ease of Analysis

This procedure may be performed outside of a standard laboratory, if well ventilated.
Produces hazardous chemicals.

Ordering Information

Vendor: CHEMetrics, Inc
4295 Catlett Rd
Calverton, VA 20138
Phone 1-800-356-3072
FAX 1-540-788-4856
Website: www.chemetrics.com

Equipment/Supplies Needed for Detergents Analysis		
Item (Catalog Number)	Quantity	Price*
Detergent kit (anionic surfactants) (K-9400)	20 tests	\$63.15
Detergent kit refill (R-9400)	20 tests	\$50.45
<i>*The per-sample expendable cost is therefore \$2.52.</i>		

F2.6 *E. COLI*

Equipment/Supplies Needed

- Colilert reagent, sterile sample bottles for 100 mL samples
- Quanti-Tray 2000
- Colilert comparator predispensed in a Quanti-Tray/2000 incubator
- UV light from IDEXX.

Enumeration Procedure

1. Add contents of one Colilert snap pack to a 100 mL room temperature water sample in a sterile vessel. The standard Colilert reagent is recommended when evaluating Enterococci simultaneously so the samples are both ready to read in 24 hours. If only *E. coli* are to be evaluated, then the faster Colilert-18 reagent can be used if reading the results in 18 hours instead of 24 hours is important.
2. Cap vessel and shake until dissolved.
3. Pour sample/reagent mixture into a Quanti-Tray/2000 and seal in an IDEXX Quanti-Tray Sealer.
4. Place the sealed tray in a $35 \pm 0.5^\circ \text{C}$ incubator for 24 hours.
5. Read results according to the Results Interpretation table below. Count the number of positive wells and refer to the MPN table provided with the Quanti-Trays to obtain a Most Probable Number.

Results Interpretation

Appearance	Result
Less yellow than the comparator	Negative for total coliforms and <i>E. coli</i>
Yellow equal to or greater than the comparator	Positive for total coliforms
Yellow and fluorescence equal to or greater than the comparator	Positive for <i>E. coli</i>

Duration of Test for Each Sample

Once the Quanti-Tray sealer is warm (10 min), it takes approximately 5 minutes per sample to label, seal and incubate the Quanti-Tray. After 24 hours, it takes 1-2 minutes to read the sample results under the UV lamp.

Hazardous Reagents

Used Quanti-Trays must be disposed of in a biohazard bag and handled by appropriate biohazard disposal facility, using similar practices as for alternative bacteria analysis methods.

Ease of Analysis

Not a difficult procedure to learn. Knowledge of proper handling of bacterial specimens is necessary. Cannot be performed in the field.

Ordering information

Vendor: IDEXX
 1 IDEXX Drive
 Westbrook, ME 04092
 Phone: 1-800-321-0207
 Fax: 207-856-0630
 E-mail: water@idexx.com
 Website: www.idexx.com/water

Equipment/Supplies Needed for <i>E. coli</i> Analysis		
Item (Catalog Number)¹	Quantity	Price*
Colilert reagent for 100mL sample (WP200)	200-pack	\$1,020.00
120mL vessel with 100mL line, sodium thiosulfate & label (WV120ST-200)	200-pack	\$90.00
97-well sterile Quanti-Tray/2000 trays (WQT-2K)	100-pack	\$110.00
Quality control kit (E. coli, Klebsiela, Pseudomonas A). (WKT 1001)	n/a	\$120.00
Colilert comparator predispensed in a Quanti-Tray/2000 (WQT2KC)	1	\$6.00
Quanti-Tray Sealer (115V) with 51-well rubber insert (WQTS2X-115)	1	\$3,500.00
6 watt UV lamp 110 volt (WL160)	1	\$89.00
Incubator 120V, 30-65°C, 14"x14"x14" (WI300)	2	\$389.00
¹ See the Enterococci table above for equipment that can be shared when conducting both analyses. *The per-sample expendable cost (reagent, bottle, and tray) is about \$6.65.		

F2.7 ENTEROCOCCI

Equipment/Supplies Needed

- Enterolert reagent
- Sterile sample bottles for 100 mL samples
- Quanti-Tray 2000
- Incubator
- UV light from IDEXX

Enumeration Test Procedure

1. Carefully separate a Snap Pack from its strip, taking care not to accidentally open the next pack.
2. Tap the reagent snap pack to ensure that all of the Enterolert powder is in the bottom part of the pack.
3. Open the pack by snapping back the top at the score line. Caution: Do not touch the opening of the pack.
4. Add the reagent to a 100 mL water sample in a sterile bottle.
5. Aseptically cap and seal the vessel.
6. Shake to completely dissolve reagent.
7. Pour the sample/reagent mixture into a Quanti-Tray avoiding contact with the foil pull tab. Seal the tray according to Quanti-Tray instructions.
8. Incubate for 24 hours at $41^{\circ}\pm 5^{\circ}$ C.
9. Read the results at 24 hours by placing a 6 watt, 365 nm wavelength UV light within five inches of the Quanti-Tray in a dark environment. Be sure the light is facing away from your eyes and toward the Quanti-Tray. Count the number of fluorescent Quanti-Tray wells. The fluorescence intensity of positive wells may vary.
10. Refer to the MPN table provided with the Quanti-Tray to determine the Most Probable Number of Enterococci in your sample.

Procedural Notes

If the sample is inadvertently incubated over 28 hours without observation, the following guidelines apply:

- Lack of fluorescence after 28 hours is a valid negative test
- Fluorescence after 28 hours is an invalid result
- Use sterile water, not buffered water for making dilutions. Enterolert is already buffered. Always add Enterolert to the proper volume of diluted sample after making dilutions.
- For comparison, a water blank can be used when interpreting results.

Duration of Test for Each Sample

Once the Quanti-Tray sealer is warm (10 min), it takes approximately 5 minutes per sample to mix, label, seal and place the Quanti-Tray in the incubator. After 24 hours, it takes 1-2 minutes to read the sample results under the UV lamp.

Hazardous Reagents

Used Quanti-Trays must be disposed of in a biohazard bag and handled by appropriate biohazard disposal facility, just like any other bacteria analysis materials.

Ease of Analysis

Not difficult procedure to learn. Knowledge of proper handling of bacterial specimens is necessary. Cannot be performed in the field.

Ordering Information

Vendor: IDEXX

1 IDEXX Drive
Westbrook, ME 04092
Phone: 1-800-321-0207
Fax: 207-856-0630
E-mail: water@idexx.com
Website: www.idexx.com/water

Equipment/Supplies Needed for Enterococci Analysis		
Item (Catalog Number)	Quantity	Price*
<i>Enteroletert reagent for 100 mL samples (WENT200)</i>	200-pack	\$ 1,020.00
120 mL pre-sterilized vessel with 100 mL line, sodium thiosulfate & label (WV120ST-200) ¹	200-pack	\$ 90.00
97-well sterile Quanti-Tray/2000 trays (WQT-2K) ¹	100-pack	\$ 110.00
Quality control kit (E. coli, Klebsiela, Pseudomonas A). (WKT 1001)	n/a	\$ 120.00
Quanti-Tray Sealer (115V) with 51-well rubber insert (WQTS2X-115) ¹	1	\$ 3,500.00
6 watt UV lamp 110 volt (WL160) ²	1	\$ 89.00
Incubator 120V, 30-65°C, 14"x14"x14" (WI300) ³	2	\$ 389.00
¹ Same expendable materials as for the E. coli method, additional should be ordered for each method ² Same as for the E. coli method and can be shared ³ Although the same, a second incubator is needed for the E. coli method because of the different temperature settings and the normal need to evaluate Enterococci and E. coli simultaneously * The per-sample expendable cost (reagent, bottle, and tray) is about \$6.65.		

F2.8 FLUORIDE (0 TO 2.00 MG/L F⁻)

Equipment/Supplies Needed

- Hach bench top or portable spectrophotometer or colorimeter (see ordering information below)
- AccuVac Vial Adaptor (for older spectrophotometers)
- SPADNS Fluoride Reagent AccuVac Ampuls.

Procedure

Refer to Hach SPADNS Method 8029 which is adapted from Standard Methods for the Examination of Water and Wastewater. This procedure involves the reaction of fluoride with a red zirconium-dye solution. The fluoride combines with part of the zirconium to form a colorless complex, thus bleaching the red color in an amount proportional to the fluoride concentration.

Duration of Test for Each Sample

Each samples takes an average of 3 minutes to test.

Hazardous Reagents

The SPANDS reagent is a hazardous solution. The used AccuVacs should be placed back in the Styrofoam shipping container for storage and then disposed properly through a hazardous waste disposal company.

Ease of Analysis

The procedure is relatively easy and fast and can be performed in the field using a portable spectrophotometer or colorimeter. However, as for all tests, it is recommended that the analyses be conducted in a laboratory, or at least in a work room having good lighting and water.

Ordering information

Vendor: Hach Company
PO Box 389
Loveland, CO 80539-0389
Tel: 800-227-4224
Fax: 970-669-2932
Website: www.hach.com

Equipment/Supplies Needed for Fluoride Analysis	
Item (Catalog Number)	Price
Fluoride Reagent (SPADNS) AccuVac Ampuls [1 set of 25 AccuVacs (2 needed per test)] (2506025)	\$ 17.00
Adapter, AccuVac vial (needed for older spectrophotometers DR/2000 and DR/3000) (43784-00)	\$ 5.40
DR/890 portable colorimeter programmed with 90 tests. Includes 2 sample cells, COD & TnT tube adapter, instrument, procedure manual and batteries. Portable instrument that can be used for many different analytes, but fewer than the following instruments. (48470000) ¹	\$ 929.00
DR/2500 spectrophotometer includes 6 one-inch round sample cells, instrument and procedure manual, and DR/Check Absorbance Standards. Compact laboratory instrument having many capabilities. (5900000) ¹	\$ 2,200.00
DR/2400 portable spectrophotometer includes one-inch sample cells, instrument and procedures manuals. Portable instrument having many capabilities. (5940000) ¹	\$ 1,995.00
DR/4000 V Spectrophotometer. Visible spectrum only (320 to 1100nm). Includes 1-inch matched sample cells/ AccuVacc and 16-mm vial adapters; a Single Cell Module; 1-inch and 1-cm cell adapters; dust cover; replacement lamp kit; an illustrated manual set; and a power cord. UV-Vis laboratory instrument having vast capabilities. (48100-00) ¹	\$ 5,500.00
¹ only one spectrophotometer is needed	
*The per-sample expendable cost is about \$1.36.	

F2.9 pH

Equipment/Supplies Needed

- Cardy pocket-sized pH meter model B-213 made by Horiba
- pH standards that come with the meter.

Calibration

The meter should hold its calibration for an extended period, but it is best to check the calibration before each sample batch.

1. Press the ON/OFF button.
2. Place approximately 1 mL of the yellow pH 7.0 standard solution onto the sensor cell (be careful not to touch the sensor with the dropper or pipette, the cell is covered with a very thin and fragile glass cover slip).
3. Press the CAL button to display the black CAL mark in the upper right corner and 7.0.
4. Calibration is complete when the CAL mark disappears. Wash the sensor with tap or distilled water and dry with a tissue.
5. Press CAL again so that 4.01 and CAL are displayed to calibrate using the pink pH 4.01 buffer. Follow the same procedure as above.

Measurement

1. Place a drop of the sample water onto the sensor cell (usually around 1 mL). Alternatively, you may dip the meter into the water to be tested.
2. When the smiley face ☺ appears, read the number.
3. Press the ON/OFF button to turn the power OFF.
4. Wash the sensor with tap water or distilled water. Wipe off any residual water on the sensor with a tissue.
5. Be sure the protective cap is covering the sensor and put the pH meter back in its protective case.

Duration of Test for Each Sample

Calibration takes around 3 minutes, and testing of each sample is only about 30 seconds.

Hazardous Reagents

None

Ease of Analysis

Simple and fast. Can be used in the field.

Ordering Information

Vendor: Cole-Parmer Instrument Co.
625 East Bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

Equipment/Supplies Needed for pH Analysis	
Item (Catalog Number)	Price
Cardy twin pH meter and accessories (EW-05759-00)	\$238.00
Replacement pH sensor cartridge (EW-05759-0)	\$105.00
Replacement pH solution kit (EW-05751-70)	\$ 29.00

F2.10 POTASSIUM

Equipment/Supplies Needed

- Cardy potassium compact meter by Horiba model C-131
- Accessories that come with the meter.

Two-Point Calibration (Monthly)

1. Turn the power ON
2. Open the sensor cover and wipe the sensor pad clean with a piece of tissue and deionized water, then wipe it dry with a piece of tissue. Repeat this several times.
3. Place a piece of sampling sheet onto the sensor pad, and drip 2 to 5 drops of the standard STD solution onto it (or drip the solution directly onto the sensor pad).
4. After the readout has stabilized, adjust the STD dial so that the display reads 20X100. After cleaning the sensor according to step (2), follow the same procedure using the standards SLOPE solution and after the readout has stabilized, adjust slope volume so that the display reads 15X10.
5. After cleaning several times with deionized water, measure the standard STD solution again.
6. Recalibrate if the reading is not $(20 \pm 2) \times 100$.
7. Wipe the sensor pad with deionized water, then wipe it dry.

One-Point Calibration (Daily)

1. Turn the power ON.
2. Open the sensor cover, and wipe the sensor pad clean with deionized water, then wipe it dry.
3. Repeat this procedure several times.
4. Place a piece of sampling sheet onto the sensor pad, and drip 2 to 5 drops of the standard STD solution on it

(or drip the solution directly onto the sensor pad).

5. After the readout has stabilized, adjust the STD dial so that the display reads 20X100.
6. Wipe the sensor pad with deionized water, and then wipe it dry.
7. If the sample is below 500 ppm (mg/L), use the SLOPE solution and adjust the STD dial to read 15X10.

Measurement

1. Place the sample directly onto the sensor pad or measurement can be aided by placing the sample onto a piece of sampling sheet.
2. Read the concentration directly from the display.
3. Clean the sensor with deionized water and wipe it clean after each sample is analyzed.
4. When finished with all samples, turn the power OFF.
5. Clean the surface of the sensor pad with deionized water and wipe dry for storage.

Duration of Test for Each Sample

Calibration takes around 5 minutes and testing of each sample is only 30 seconds.

Hazardous Reagents

None

Ease of Analysis

Simple and fast. Can be used in the field.

Ordering information

Vendor: Cole-Parmer Instrument Company
625 East Bunker Court
Vernon Hills, IL 60061-1844
Phone: 1-800-323-4340
FAX: 847-247-2929
Website: www.coleparmer.com

Equipment/Supplies Needed for pH Analysis	
Item (Catalog Number)	Price
Cardy potassium compact meter and accessories (EW-05755-00)	\$239.00
Replacement cardy potassium sensor cartridge (EW-05755-500)	\$ 64.00
Replacement cardy potassium solution kit (EW-05755-60)	\$ 33.00

Note: This procedure is rapid and inexpensive, however, it only has a detection limit of about 1 mg/L, and reads in increments of 1 mg/L. This level of precision is not typically a problem for moderately contaminated samples (when the results are most useful); however, it presents challenges when used for cleaner water. Specifically, since the Flow Chart Method relies on the ammonia to potassium ratio to distinguish between washwaters and sanitary

wastewaters, a “non detect” (i.e., <1) potassium concentration results in an indeterminate ratio value. Where clean water is being analyzed and more sensitive potassium values are needed, the only real option is to use other laboratory methods (either ICP or atomic absorption). Other simple field procedures (such as the method supplied by HACH) rely on a photometric measurement of a floc and are not very repeatable for these types of samples.

F2.11 TOTAL HARDNESS (10 – 4000 mg/L as CaCO₃)

Equipment/Supplies Needed

- Hach digital titrator
- Total hardness titration cartridge
- ManVer 2 hardness indicator
- Hardness 1 buffer solution.

Procedure

Refer to Hach Method 8213 for Hardness, Total (10-4000 mg/L as CaCO₃) digital titrator method using EDTA. This procedure involves buffering the sample first to pH 10.1, adding of the ManVer 2 Hardness Indicator, which forms a red complex with a portion of the calcium and magnesium in the sample, and then titrating with EDTA. The EDTA titrant reacts first with the free calcium and magnesium ions, then with those bound to the indicator, causing it to change to a blue color at the end point.

Duration of Test for Each Sample

Approximately 5 minutes.

Hazardous Reagents

The mixture of sample, buffer solution, hardness indicator, and EDTA must be stored properly in a labeled container until disposal by a hazardous waste disposal facility.

Ease of Analysis

This procedure is not recommended to be performed in the field. Produces hazardous chemicals.

Ordering information

Vendor: Hach Company
 PO Box 389
 Loveland, CO 80539-0389
 Tel: 800-227-4224
 Fax: 970-669-2932
 Website: www.hach.com

Equipment/Supplies Needed for Total Hardness Analysis		
Item (Catalog Number)	Quantity	Price*
Digital Titrator with plastic case, manual and 5 straight delivery tubes (1690001)	1 titrator	\$105.00
Total hardness titration cartridge (EDTA 0.0800M) (1436401)	1	\$10.70
Total hardness titration cartridge (EDTA 0.800M) (1439901)	1	\$10.70
Delivery tube, (straight with J hook) for titration (1720500)	Pack of 5	\$4.85
ManVer 2 Hardness Indicator Powder Pillow (85199)	1 pack of 100 pillows	\$9.85
Hardness 1 buffer solution (42432)	One 100 mL bottle	\$8.40

**The per sample expendable cost is about \$0.25, depending on the hardness level.*

F2.12 TURBIDITY

Equipment/Supplies Needed

- Benchtop or portable turbidimeter. The range of readings in NTU will depend upon the instrument.

Procedure

(This is a general procedure for turbidity. Follow your turbidimeter's instructions):

1. First, the instrument must be calibrated using the standards supplied with the instrument. If calibration is satisfactory, continue with sample measurement.
2. Samples are normally stored under refrigeration. Before analyzing for turbidity, the samples must first be brought back to room temperature. This is done to prevent the formation of frost on the outside of the glass sample cells used in the turbidity measurement.
3. Pour the sample into a sample cell (until almost full or to the fill line), cap the cell, then turn it upside down 2 to 3 times for mixing. Do not shake vigorously.

4. Keep the sample cell vertical for 4-5 seconds and wipe the outside to remove fingerprints.
5. Place the cell into the turbidity meter and take a reading.

Duration of test for each sample

Approximately one minute. This does not include the time spent bringing the sample to room temperature.

Hazardous Reagent

None

Ease of Analysis

Relatively simple and may be performed outside of the laboratory using a portable turbidimeter.

Ordering Information

Vendor: Hach Company
 PO Box 389
 Loveland, CO 80539-0389
 Tel: 800-227-4224
 Fax: 970-669-2932
 Website: www.hach.com

Equipment/Supplies Needed for Turbidity Analysis		
Item (Catalog Number)	Quantity	Price
2100P Portable Turbidimeter range 1-1000 NTU Includes nine sample cells, primary standards, silicone oil & oiling cloth, manual, quick reference card and case. (4650000)	1	\$837.00

Appendix F3. METHODOLOGIES AND LAB TESTING OF TECHNIQUES TO
MEASURE DETERGENTS

F3.1 CHEMETRICS DETERGENT TEST KIT

Detergents were measured using the *CHEMetrics* detergent test kit, which detects Methylene Blue Active Substances (MBAS), an important ingredient of detergent products. The minimum detection limit (MDL) of the kit is 0.25mg/L. This is a very simple test, but the accuracy of the tests depends on the analyst's skill with the color comparator. One of the problems with this method is the upper limit of 3 mg/L. Higher values can only be measured with dilution of the sample prior to analysis. This extra step requires extra time when measuring laundry, carwash and sewage samples, when the detergent values are in hundreds of mg/L.

This kit also contains chloroform, an expected carcinogen. Great care must therefore be taken when conducting this analysis and when handling the kit materials. The alternative detergent field test kit from HACH uses much larger quantities of benzene, also a known carcinogen, and is not as well contained as the chloroform in this preferred kit. An important aspect of this research was investigating alternative analytes that could be used instead of detergents.

The main components of the *CHEMetrics* detergent test kit (Figure F3.1) are:

1. Test tube
2. Comparator device
3. Snapper
4. Double tipped ampoule containing chloroform and other reagents (blue stained)
5. CHEMets ampoule (empty vacuum ampoule)



Figure F3.1: *CHEMetrics* detergent test kit components

Test Procedure Summary

This test should preferably be conducted in a laboratory fume hood due to the possibility of exposure to chloroform.

1. Pour 5 mL of the sample into the test tube.
2. Snap one tip of the double tipped ampoule, keeping the other tip inside the tube, but above the sample level. Invert the snapped tip into the tube and snap the other tip of the ampoule. Let the blue chemical (containing chloroform) completely empty into the test tube.
3. Cap the tube tightly and shake the solution for 30 seconds. Keep the solution undisturbed for 1 minute in a test tube rack.
4. Remove the cap from the tube and insert the vacuum CHEMetrics ampoule into the test tube. Care must be taken so that the small plastic tube at the tip of the ampoule touches the bottom of the tube.
5. Snap the CHEMetrics ampoule tip by the side of the test tube and let the solution flow through the tube into the CHEMetrics ampoule.
6. Take off the plastic tube and wipe off the tip of the ampoule. Put the provided white cap on the tip of the ampoule and place it in the color comparator.
7. Compare the color of the solution inside the ampoule with the color

comparator. The colors range from light blue (0.25 mg/L) to dark blue (3 mg/L). If the color is darker than the given colors in the comparator, the sample needs to be diluted and retested. No color indicates <0.25 mg/L value for detergents. The test tube needs to be disposed of carefully because it contains a hazardous chemical (chloroform).

Harmful Chemicals in CHEMetrics Detergent Test Kit

The main components of the double tipped ampoule are methylene blue, sulfuric acid, sodium phosphate, water and chloroform. Chloroform may affect the liver, kidney and central nervous system, and is a known carcinogen. On exposure, it causes irritation to eyes, skin and mucous membranes. It may also cause burning of the throat, mouth esophagus and stomach. It may also cause nausea, vomiting and diarrhea. Wash your hands thoroughly after handling the kit and conduct the analysis in a well-ventilated area, preferably in a laboratory fume hood. Avoid contact with the eyes. Safety glasses and gloves are required while doing this test. If there is a spill, take up with an absorbent material. Keep the reagents in the ampoule for final disposal, in accordance with regulations.

F3.2 FLUORESCENCE MONITORING USING THE GFL-1 FLUOROMETER

Introduction

Fluorescence is the property of the whiteners in detergents that cause treated fabrics to fluoresce in the presence of ultraviolet rays, giving laundered materials an impression of extra cleanliness. These are also referred to as bluing, brighteners or optical brighteners and have been an important ingredient of most laundry detergents for many years. The effectiveness of the brighteners varies by the concentration of the detergents in the wash water. The detection of optical brighteners has been used as an indicator for the presence of laundry wastewater, and municipal sewage, in urban waters.

One method of quantifying fluorescence in the laboratory is by using a fluorometer calibrated for detergents. In our tests, we used the GFL-1 Portable Field fluorometer (Figure F3.2).

The components of the GFL-1 Fluorometer are the power switch, sample chamber, battery compartment, source module, detector filter cartridge, display, keypad, and the interface port. A 1.2 Ah rechargeable lead-acid battery powers the unit when in the field. The fluorometer contains high efficiency interference filters optimized for fluorescence detection. It contains a silicon photodiode detector and a LED source. The interface port is also used as the battery charger port. A 192 X 192 dot LCD screen is used for text and graphical data presentation.



Figure F3.2: GFL-1 Portable Field Fluorometer

Calibration

Before the instrument is used, it should be calibrated with a detergent solution. No general standard detergent solution is available, so a commercially available detergent is used to prepare standard solutions. For this research, a common commercial detergent, Procter & Gamble's *Tide™* was used. The purpose of calibrating the fluorometer is to set the instrument fluorescent signal levels to correspond to different concentrations of this commercial detergent. Single point and multipoint calibrations are available with this fluorometer. The manufacturers report that the solution used in calibration is unimportant in that the procedure is the same regardless of the solution used. A five-point calibration method is used for instrument calibration. To test a sample, the instrument must be in "test mode." The test mode cannot be used until a calibration table has been built, or an existing one is made active. If there is no active calibration table, the test mode screen will automatically default to the "calibration menu" screen.

To install a new calibration table, select CREATE CAL TABLE by pressing 1 on the keypad. Soon the cal table builder screen appears on the display. Since a five point calibration is being done, six different concentrations of Tide detergent were made: 0.5mg/L, 5mg/L, 10mg/L, 50mg/L, 100mg/L, 500mg/L. A concentration of 25 mg/L of Tide corresponds to a typical working solution for a batch of laundry. The sample bottles for the GFL-1 fluorometer come with the instrument. These are the only sample bottles that can be used for the measurement of fluorescence. There are five steps in making a calibration table:

Step 1

The screen will prompt to insert the most concentrated reference in order to set the detector gain. In this case, the highest concentration is 500mg/L. Press ENTER.

Step 2

Insert the blank and press ENTER.

Step 3

The next step is to enter the calibration units (e.g., mg/L). Pressing the ENTER key takes the user to the next step.

Step 4

This step prompts the user to insert a reference sample of any concentration. After inserting the reference sample, press ENTER. The screen will then prompt the user to enter the concentration value for the inserted reference sample. After setting the known reference, the screen will ask whether or not to do another point. Press YES and repeat the above sequence until you have inserted all the prepared reference samples. The reference samples should be inserted in a random fashion and not in the order of increasing or decreasing values of concentration.

Step 5

The last step prompts the user to name the calibration table. It should be noted that calibration tables are not saved until a name is given to the table. Then press ENTER.

Now the fluorometer is ready to start running samples.

Sample Test Mode

Figure F3.3 is the first screen display shown after switching on the fluorometer. Press 1 for the test mode, since the calibration table has already been saved.

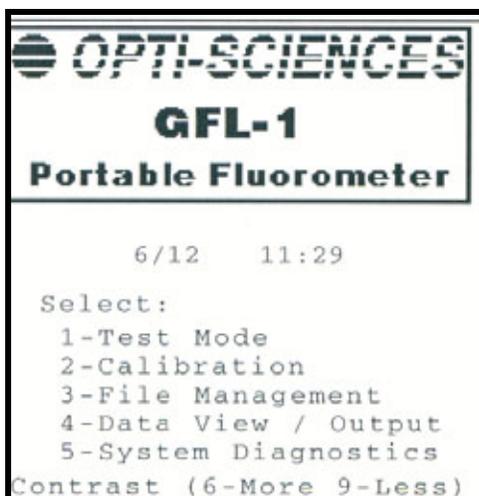


Figure F3.3: Main Menu

The screen will then display the following (Figure F3.4):

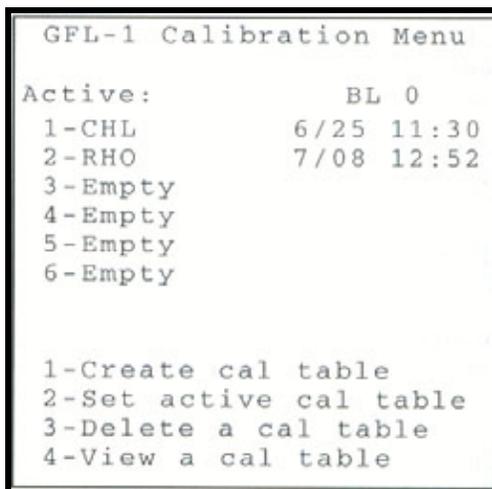


Figure F3.4: Calibration Menu

Press 2 for using the saved calibration table as the active calibration table in the memory. The next screen would prompt you to enter the desired table number saved. If you have saved only one calibration table, press 1.

Place a blank sample in the sample chamber and press ENTER (Figure F3.5). You will then see the screen displayed in Figure F3.6.



Figure F3.5: Placing Sample into Sample Chamber

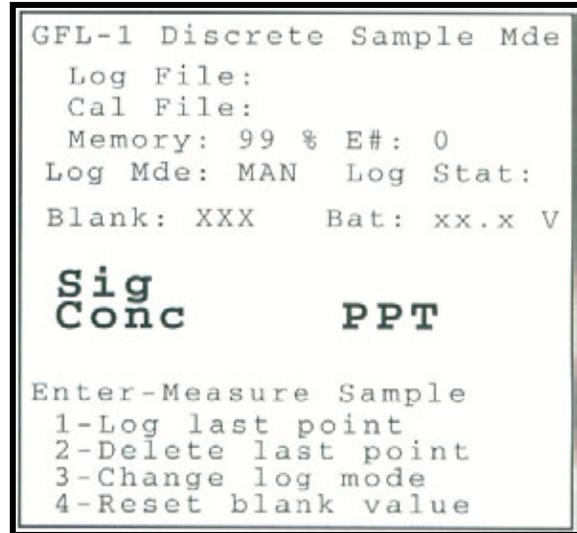


Figure F3.7: Discrete Sample Mode

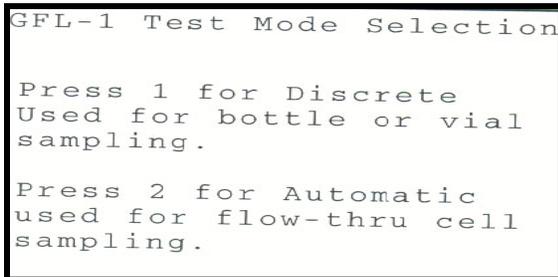


Figure F3.6: Test Mode Selection

Press 1 for doing discrete bottle sampling. A new screen will appear (Figure F3.7).

With calibration complete, the instrument is ready to analyze the samples. To run a test, simply load a sample into the chamber and press ENTER. The unit will measure the sample and present the data a few seconds later. A busy message indicates that the test is in progress. Press ESC to return to the main menu.

Initial Tests using the Fluorometer

Initial tests were conducted after the first calibration to get an indication of the repeatability and drift of the results obtained from the new instrument. Five different concentrations of Tide detergent samples were made and tested for fluorescence after varying periods of time. The results of these tests are shown in Figure F3.8.

It is obvious that the fluorescence signal from Tide degrades with time and that the analyses should be evaluated within two hours. Other samples of commercial and household detergents were also evaluated and degradation of fluorescence with time was also identified. The largest changes occurred between about one and two hours after sample preparation. There was very little change after this initial two hour period. In the real world, the time between mixing of a laundry detergent with the washwater at the laundry, its discharge, and its analysis in the laboratory is at least two hours. Therefore, the fluorescence values used are those obtained after the signals have reached a relatively constant value. The results of the tests on certain commercial and household detergents are shown in Figure F3.9.

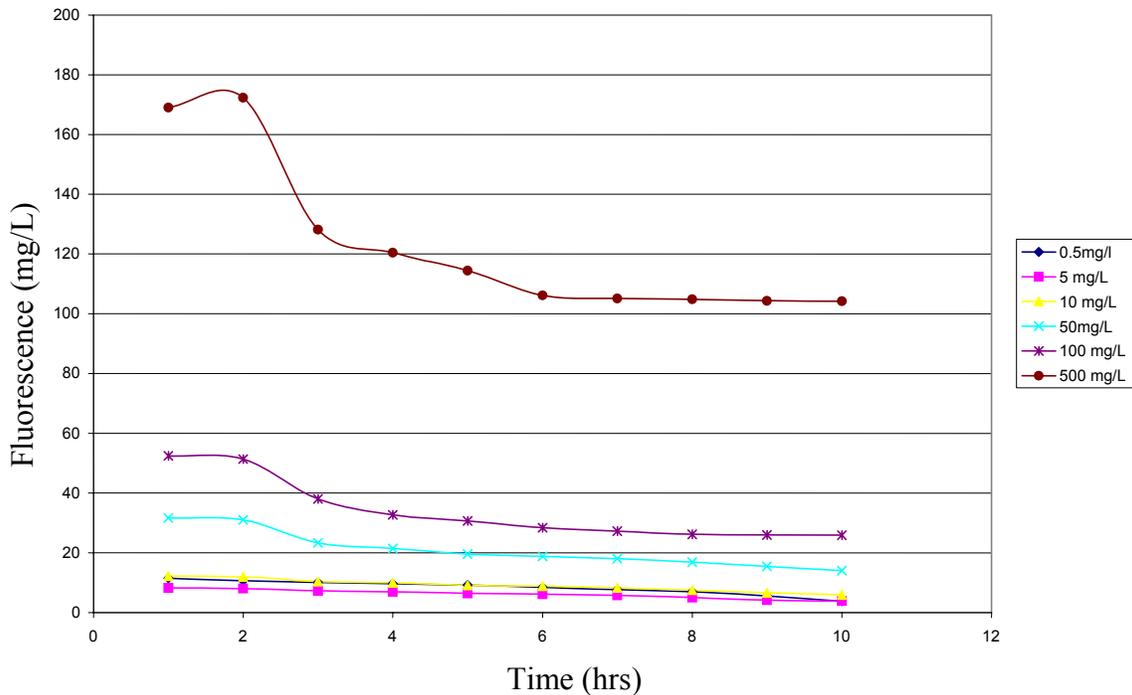


Figure F3.8: Changes in Tide Detergent Fluorescence over Time

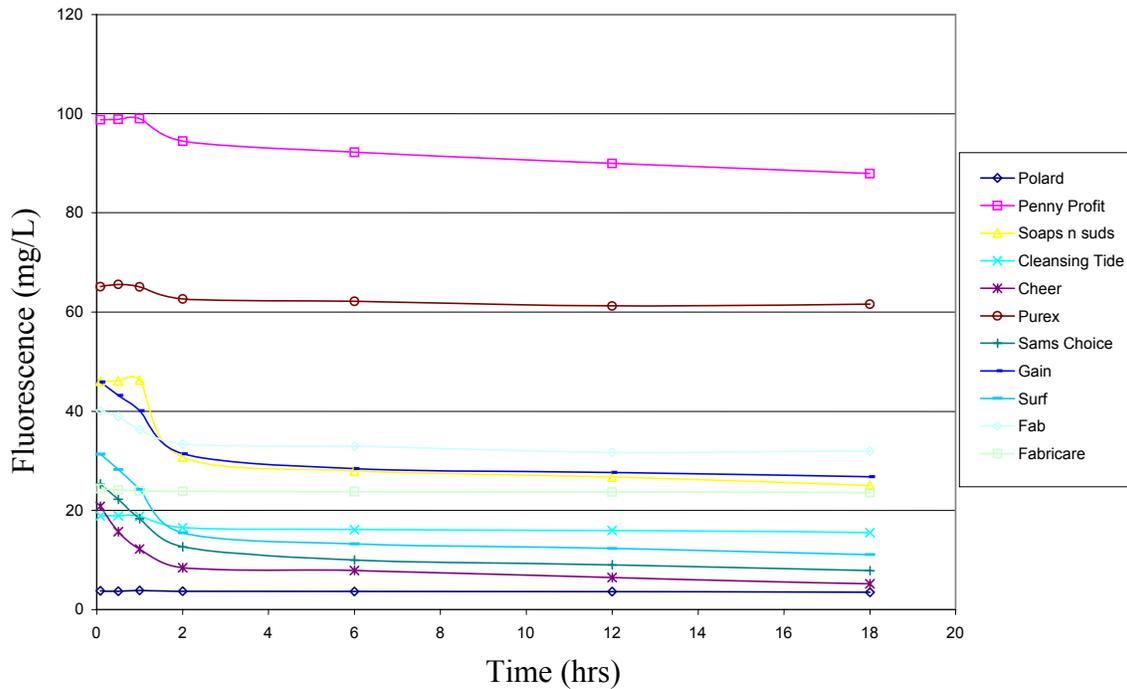


Figure F3.9: Changing Fluorescence with Time

The commercial laundry detergent samples in this graph were *Polard*, *Penny Profit*, *Soaps n Suds*, and *Cleansing Tide*. The others are household detergents (*Cheer*, *Purex*, *Sam’s Choice*, *Gain*, *Surf*, *Fab*, and *Fabricare*). *Soaps n Suds* had a steep drop in fluorescence after one hour of preparation of the sample. After two hours, the fluorescence values stayed relatively constant without further changes. There was only one sample (*Polard*, a commercial detergent) that did not show any change in its fluorescence value. This detergent also had the lowest fluorescence signal of any of the samples. Although equal concentrations of all of these detergents were evaluated (50 mg/L), the fluorescence values ranged from 5 mg/L to 100 mg/L, as Tide. Obviously, the ingredients of the different detergents varied greatly.

F3.3 SURFACE TENSION TEST FOR THE DETECTION OF DETERGENTS

Introduction

This discussion presents a proposed sensitive method to detect detergents without hazardous chemicals and with standard laboratory equipment. The method uses the property of the detergent to decrease the surface tension of the bubbles formed when the sample is agitated. Different detergents at different pHs were used during these tests. Results indicate that the method can be used to detect detergent concentrations above 1 mg/L, and can be used as a presence/absence test for concentrations above 0.3 mg/L. The method also was verified with samples collected from a known inappropriate detergent discharge.

One of the effects of detergents in water is the reduction in surface tension. When a sample of water with detergent is agitated, air is mixed with water, creating bubbles. Because the surface tension is reduced, the tension that controls the pressure of the air is low and the surface film is not destroyed. This property can be used to estimate the detergent concentration based on the amount of foam produced after the sample is agitated.

The amount of foam formed after a sample of water with detergent is agitated can be affected by various parameters. Temperature can affect the surface tension of the water. An increase in the temperature will reduce the surface tension. Foam production can also be affected by the chemical composition of the water. As an example, low pH will decrease the foam production.

The following discussion presents an inexpensive, safe, and reasonably sensitive method to estimate the detergent concentrations in a water sample using common laboratory equipment and without hazardous reagents.

Methods

General laboratory equipment was used to generate foam from samples of distilled water and detergent at different concentrations. The idea of the experiment was to drop the sample inside a burette from a constant elevation and to measure the height of the foam created 10 seconds and 1 minute after the last drop fell.

Apparatus:

- A rectangular base support and rod assembly
- A 50 mL burette
- A clamp to hold the burette

- A 25 mL blowout pipette
- Two 10 mL pipettes
- A stop watch
- A 200 mL volumetric flask
- A portable pH meter

A rectangular base support was used to hold the burette vertically. Using a 25 mL pipette, a 25 mL sample was released into the 50 mL burette. The sample was released by free fall from near the top of the burette, taking care that the sample does not touch the wall of the burette to maximize the amount of bubbles that can be produced. An initial reading of the foam height was taken 10 seconds after the pipette was drained. A final reading was obtained 50 seconds later.

Reagents:

- Detergent (Tide)
- Distilled water
- 500 mL NaOH 1N
- 500 mL H₂SO₄ 0.02N

Four samples at the same concentration were created at the same time. Four stands and four burettes were used for each concentration. After the reading, the burettes were washed for more than 2 minutes until they were clean.

To obtain more foam during the experiment, the pH was increased up to 12. The sample was diluted with distilled water and 10 mL of 1N NaOH added. The sample was prepared in a 200 mL volumetric flask. NaOH was selected because it is present in most of the detergents. After the reading was taken, the sample (200 mL) was neutralized with 100 mL 0.05N H₂SO₄ before disposal.

Results

Table F3.11 shows the foam reading above the water surface 10 seconds and 1 minute after the last drop.

The results indicate that this method can be used as a presence/absence test for detergent concentrations between 0.2 and 1 mg/L (as Tide) and to estimate concentrations above 1 mg/L. The method is simple and does not require specialized equipment.

An advantage of this method is that the equipment is easily available and inexpensive. The disadvantages are the variability in readings due to changes in temperature and characteristics of the detergents.

Figure F3.10 shows the results from concentrations between 10 and 50 mg/L. For readings above 10 mg/L, if the level of detergent increases the height of the foam also increases in a parabolic shape. It was also observed that the repeatability of the results decrease at high levels.

For levels of detergent lower than 10 mg/L, there is not an important change in the reading. The minimum reading that can be

obtained from the burette is 0.05 mL. For samples in this range the reading is close to the precision of the instrument. Figure F3.11 shows the results from concentrations between 0 and 5 mg/L.

Readings below 1.0 mg/L create a circle of bubbles around the wall of the pipette. This circle was not present when distilled water was used. This procedure can be used as a presence/absence test. The circle was observed for concentration of detergent higher than 0.2 mg/L.

Conclusions

The new method is an inexpensive, safe and moderately accurate method to estimate the presence of detergents in concentrations above 0.2 mg/L. For detergent concentrations above 10 mg/L, the method can be used to quantify the concentrations. These higher concentrations have been observed in sewage, industrial discharges, laundries and car wash areas.

Table F3.11: Foam Readings Over Time

Concentration (mg/L, as Tide)	Foam Height after 10 sec. (mL)	Foam Height after 1 min. (mL)
0	0	0
0.1	0	0
0.2	T	T
0.3	T	T
0.4	T	T
0.5	T	T
0.7	T	T
1	0.05, 0.05, 0.05, 0.05	0.05, 0.05, 0.05, 0.05
2	0.1, 0.1, 0.1, 0.1	0.1, 0.1, 0.1, 0.1
3	0.1, 0.1, 0.15, 0.15	0.1, 0.1, 0.15, 0.15
5	0.15, 0.15, 0.15, 0.15	0.15, 0.15, 0.15, 0.15
10	0.2, 0.2, 0.2, 0.2	0.35, 0.4, 0.4, 0.4
20	0.8, 0.6, 0.6, 0.6	1.5, 1.3, 1.4, 1.3
50	2.6, 2.6, 3.0, 2.8	3.8, 3.5, 3.7, 3.6

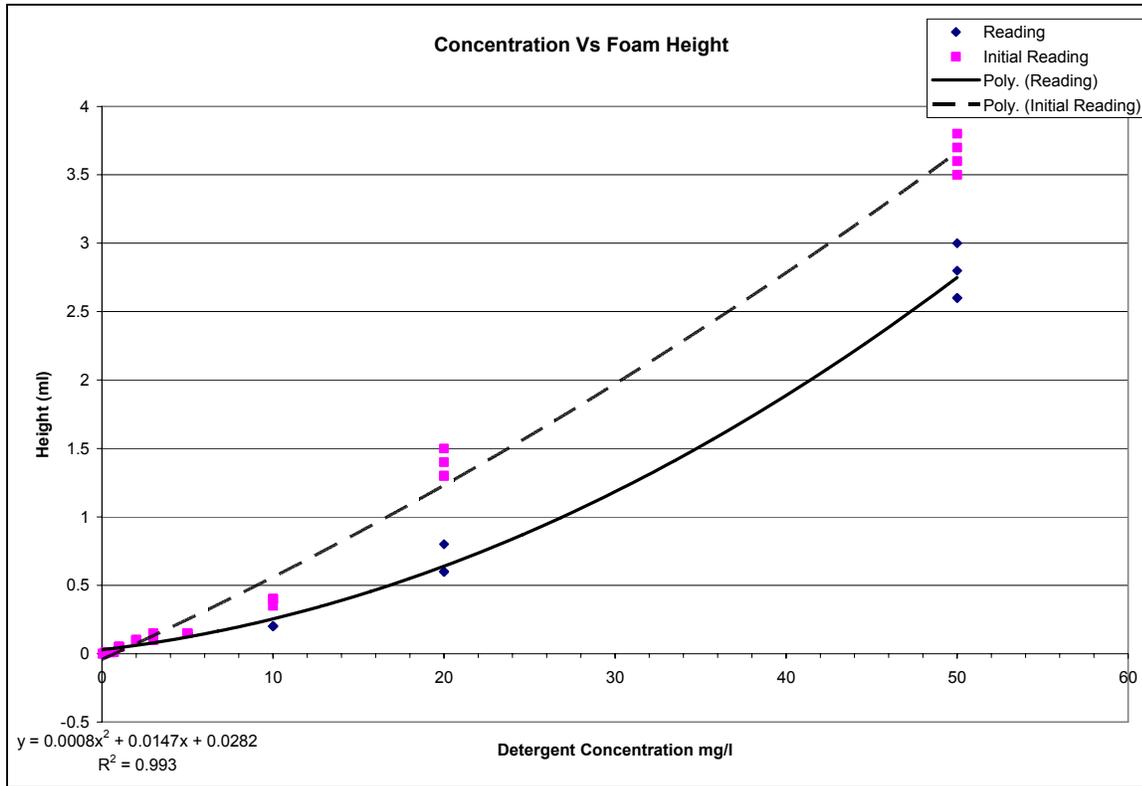


Figure F3.10: Correlation Between Concentration and Foam Height at Higher Concentrations

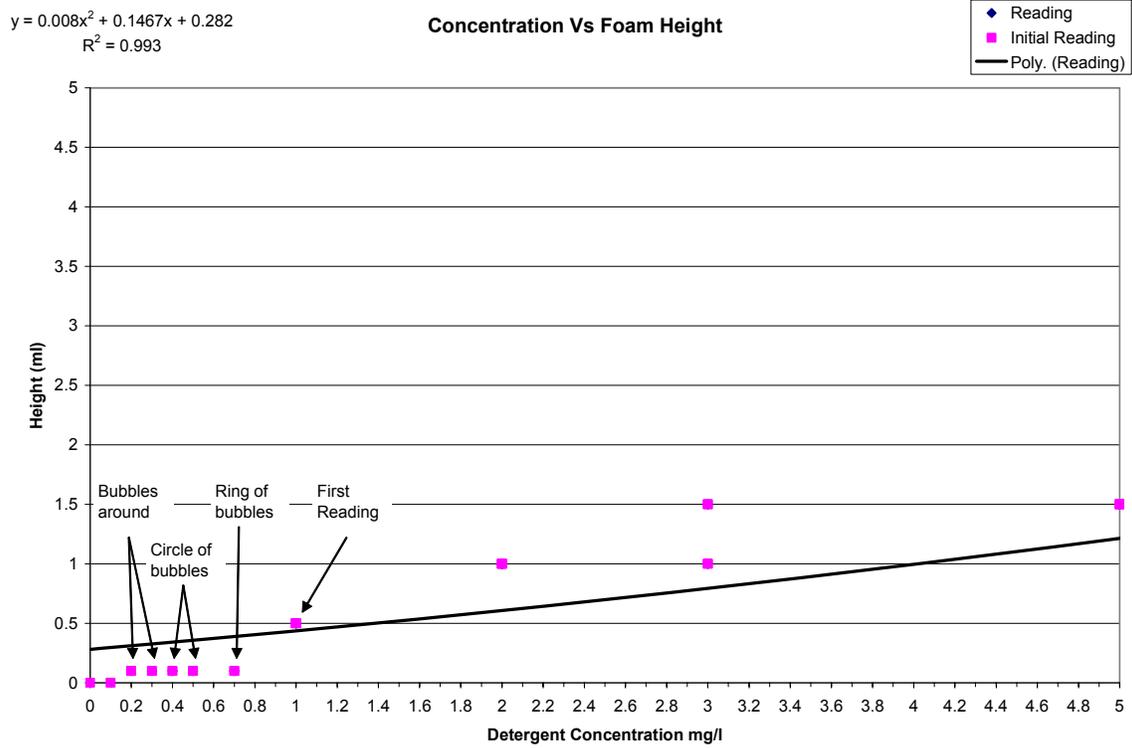


Figure F3.11: Correlation Between Concentration and Foam Height at Lower Concentrations

APPENDIX F4: LAB TESTING OF “OPTICAL BRIGHTENER MONITORING”
TO FIND INTERMITTENT DISCHARGES

Introduction

Fabric brighteners are fluorescent dyes added to soaps and detergents. These are used to produce a brightening effect after laundering. They absorb the UV rays of the sunlight and then fluoresce as a bright blue.

Optical Brightener Monitoring (OBM) is a new method for detecting fluorescent materials in water samples. It is based on a method used to measure the presence of strongly fluorescent tracer dyes.

Briefly, cotton pads that are free of fabric brighteners are used for checking the presence of optical brighteners in water samples. Cotton pads are soaked in the water sample and then dried in a darkened room. The pads are then viewed with ultraviolet (UV) light to check for the presence of fluorescence. This is an inexpensive, but much less sensitive, method for the detection of fluorescence compared to fluorometers.

Homemade OBM traps are inexpensive and easy to make. Table F4.1 lists the average costs of the supplies needed to make OBM traps, most of which can be found at a local hardware or home improvement store.

The following tests were conducted to determine how effective this test would be to detect inappropriate discharges originating from washwaters or sanitary wastewaters to storm drainage systems. This test may have several advantages compared to other methods used to detect these wastewaters: fluorometers are very expensive, detergent analyses can be hazardous, and the boron content of detergents varies widely. In addition, the OBM method usually involves placing the test pads in the targeted water for extended periods (up to several days) and may therefore be sensitive to intermittent discharges. These tests were therefore conducted to determine the sensitivity of the OBM method and to investigate its reliability under both field and laboratory conditions.

Table F4.1: Start-Up Costs for Optical Brightener Monitoring
(Source: Sargent and Castonguay, 1998)

Equipment	Cost
25 - 1/2" wire mesh (cages)	\$ 75.75
42 feet black plastic mesh	\$ 4.50
100 yards 20 lb. test monofilament	\$ 2.00
500 elastics	\$ 10.00
1000 staples	\$ 5.00
Unexposed labels	\$ 12.00
5 boxes plastic bags	\$ 5.00
200 craft sticks	\$ 2.00
25 aluminum spikes	\$ 23.00
1 case unwashed cotton pads	\$ 88.00
12 rubber gloves	\$ 16.00
6 watt UV light with 2 bulbs	\$ 240.00
Total	\$ 483.25

Test Procedure

Step One:

Care should be taken so that samples are handled properly with no cross contamination. Gloves free of fabric brightener should be worn at all times when handling the test materials. The field test kit includes brightener-free cotton pads and a sampler cage to hold the pads in place if they are to be deployed for extended periods. The sampler cage is a non-metallic plastic, or a vinyl coated black wire cage having 0.5" openings. The cage consists of two hinged pieces approximately 5" by 5". This cage should be fabricated so that it will hold the fabric pads at approximately a 30 to 45 degree angle. The open end of this cage is held closed with an elastic band. A 4 to 6 watt long-wave fluorescent UV ultraviolet light is used to observe fluorescence on the fabric.

Step Two: (Placement)

At an outfall or small stream sampling location, the wire cage is secured by a heavy monofilament fishing line tied to a branch, a rock, or an aluminum spike. In sampling catchbasins, the wire cage is lowered into the catch basin by the monofilament fishing line that is then tied to the grate cover or other object. The wire cage is suspended within the water flow. The fabric pad is generally exposed for seven days. If intermittent flows are present, the device may be kept for an even longer period. However for quick sampling, the pad needs to be exposed to a water sample for at least one hour. If rust or sediment obscures the sample, then the duration needs to be shortened.

Step Three: (Retrieval)

After the samplers are retrieved from the water, the pads are removed from the sampling device. The pads are then rinsed in the sampling water to remove any surface sediment, and squeezed to remove excess water without tearing or ripping the pads. The pads are also labeled (see Figure F4.2).

All labels must be analyzed using the UV light to check for the presence of brighteners, as most white paper contains optical brighteners that can interfere with the optical brightener measurements of the pads. Label information should include, location, day/time of placement, and day/time of removal. The stiff paper labels are stapled to the retrieved sampling pads, placed in a zip lock bag, and kept in the dark as they are being transported to the laboratory. Upon arrival at the laboratory, the pads are dried in a darkened room (where they will not come into contact with direct sunlight) by hanging on a non-cotton monofilament line (see Figure F4.2). The line should either be replaced or cleaned by a cotton pad after every use.

Step Four: (Analysis)

The pads are viewed in a darkened room using a long-wavelength UV light source. The pads are easiest to examine in a dark room using a special UV lamp viewing cabinet. A non-exposed pad is used as a control. The pad will fluoresce if it is positive for brighteners, while it will be noticeably drab like the control pad if it is negative. Uneven exposure of the pad to optical brighteners may result in uneven fluorescence of the pad. If the reason for partial fluorescence can be explained then the pad should be regarded as positive. Specks or spots of fluorescence on the pads may be ignored.



Figure F4.2: Labeling the Pad



Figure F4.3: Drying the Pads

Method Modifications

While reviewing the prior methods for the OBM for inappropriate discharge detection, the following issues were brought up:

- a) Do the pads need to be left in the field for extended periods and how long should the pads be exposed to the sample water?
- b) Are there any detrimental effects of direct exposure to sunlight while drying the cotton pads?
- c) What is the sensitivity of the OBM compared to the other tests used to detect washwaters and sanitary wastewaters?

The above points are discussed in the following paragraphs.

Leaving the cotton pad and the sampling device at the sampling location

If there is continuous flow at an outfall, there is no need to keep the pads at the outfall for extended periods. If grab samples are collected from the flowing outfalls for later chemical tests, a separate sample bottle can be conveniently collected for optical brightener tests. During our analyses, the cotton pads were immersed in the sample bottles at the time of sample collection. This sampling modification greatly reduced the time and effort needed to conduct the tests. Our initial tests indicated that the high sediment loads associated with the outfall discharges would hinder the ability to measure the fluorescence due to coating the fabrics with silt. If the pads were placed in the OBM sample bottles when the water was collected, the time required to bring the samples to the laboratory was thought to be sufficient to affect the pads. Tests were conducted in the laboratory to determine the time needed to affect the pads. The standard procedure used at least a one hour exposure period.

Direct exposure to sunlight while drying the cotton pads.

There was a concern related to the degradation of fabric fluorescence in the presence of sunlight, especially after the fluorometer tests indicated significant decreases in water sample fluorescence during the first hour or two after detergent mixing. In order to test this concern, two samples were prepared with the same concentration of detergents. Two cotton pads were immersed in each of the bottles. One was dried under the direct exposure of sunlight, while the other one was dried in a dark room. After 24 hours, both sets of pads gave the same fluorescence under the ultraviolet light. Therefore, it was concluded that direct sunlight exposure to the dried cotton pads did not affect the test results.

Other sampling and laboratory practices that were important included using gloves while handling the pads, and testing the cotton pads for fluorescence under the UV lamp before their use.

Laboratory Verification using Standard Samples and Field Use in Cribbs Mill Creek

The basic OBM method is a presence/absence test, with unknown sensitivity. In order to make this test more useful, additional tests were conducted. The initial test used different Tide detergent standards. Tide detergent samples were made with concentrations of 0.5 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, 30 mg/L, 50 mg/L, 100 mg/L, and 500 mg/L. Samples from each dried test pad were attached onto a card, as shown in Figure F4.4.



Figure F4.4: Standard Tide OBM Pads

As can be seen in Figure F3.4, concentrations below 35 mg/L all look identical. The 50 mg/L Tide solution (the first one with an obvious fluorescence response) is representative of a full-strength washwater as typically used in household laundry. Thus, it may be concluded that the OBM method may not be useful for samples having anything less than full-strength washwaters.

The maximum fluorescence concentration obtained from the Cribbs Mill Creek samples was 17mg/L (as Tide), and no positive responses for fluorescence using the OBM method were found.

Conclusion

This test was originally designed to identify faulty septic systems and storm drainage systems using fluorescent dyes. The fluorescent dyes (Fluorescence and Rhodamine FWT) used in these types of tests are very strong dyes and are used in moderate concentrations. They are therefore much easier to be detected by the cotton pads and the OBM method than the fabric brighteners in washwaters. OBM is a quick, easy, and inexpensive method, but can only reliably detect undiluted washwaters, and likely will miss the more common diluted washwaters found as inappropriate discharges. Other simple methods exist that are more sensitive, although the OBM method may be most suitable if intermittent discharges of undiluted washwaters are expected.

Appendix F5. IN-HOUSE ANALYTICAL CONSIDERATIONS FOR INDICATOR PARAMETERS

Introduction

Program managers need to understand the basic analytical options and safety considerations, for each analytical method used to measure indicator parameters. This understanding helps program managers choose what indicator parameters to collect and where they should be analyzed. This section provides a summary of the basics.

Table F5.1 summarizes the recommended analysis method associated with each indicator parameter. An extended

description of each analysis method is provided below.

Colorimetric – Colorimetric methods utilize specialized instruments such as a colorimeter or a spectrophotometer (Figure F5.1). The two instruments are similar and quantify parameter concentrations by adding reagents to the sample and passing through a defined spectrum of light. In general, spectrophotometers can analyze a much broader range of parameters than colorimeters.

Table F5.1: Analytical Considerations for Illicit Discharge Indicator Parameters			
Indicator Parameter	Method	Analysis Type	Limit of Detection
Ammonia	HACH Method 8155	Colorimetric	0.01 mg/L
Boron	HACH Method 10061	Colorimetric	0.02 mg/L
Chlorine	HACH Method 8021	Colorimetric	0.02 mg/L
Color	HACH Color Wheel	Color Comparator	1 color unit
Conductivity	Various Probe or Meter Techniques	Probe or Meter	N/A
Detergents – Surfactants	Chemetrics Chemets	Color Comparator	0.25 mg/L
<i>E. coli</i> , Total Coliform, Enterococci	IDEXX: Colilert Or Enterolert	IDEXX: Colilert Or Enterolert	1 MPN/100 mL
Fluoride	HACH Method 8029	Colorimetric	0.01 mg/L
Hardness	HACH Method 8213	Titration	1 mg/L
Potassium	HACH Method 8049	Colorimetric	0.1 mg/L
	Horiba Probe	Probe	5 mg/L
PH	Probe (Various)	Probe or Meter	1 pH unit
Turbidity	Various Turbidity Meters	Probe or Meter	1 NTU



Figure F5.1: Spectrophotometer

Color Comparator – This analysis method is a less quantitative version of the colorimetric method. Samples are prepared by adding reagents, and assessing the color in comparison to a color cube (see Figure F5.2) or color disk that assigns a concentration for different color shades.



Figure F5.2: HACH Color Cube Comparator

Probes – These methods use a probe to pass an electrical current through the sample for specific light wavelength (for most indicators) or measure the scatter of light (for turbidity). While results are immediate, lab analysts need to frequently calibrate the probe using standard solutions to assure accurate data.

Titration – Titration techniques measure the concentration of indicator parameters by determining the amount of a reagent needed to produce a specific reaction in the sample, which is often indicated by a color change. Lab analysts carefully record the amount of reagent added to the sample using a “burette,” which is a graduated cylinder with

a valve-controlled opening at the bottom. An alternative and more precise technique is a digital titrator. Both methods rely on equations or lookup tables that relate to the amount of reagent added to the estimated concentration of the indicator parameter.

IDEXX Techniques: Colilert or Colisure - These proprietary methods are used to measure *E. coli*, total coliform and Enterococci bacteria. Samples are sealed along with a reagent in a specialized tray that is then placed into an incubator for 24 hours. The analyst then measures the number of cells in the tray that have changed color or shine under a fluorescent bulb, which is used to indicate the amount of bacteria in the sample (Figure F5.3). The IDEXX method uses a standard chart to relate the number of cells that have a positive reaction to the presence of bacteria. The IDEXX method is fairly simple and safe, but requires fairly expensive equipment.

Safety and Waste Management Considerations

Each analysis method has special safety and waste disposal considerations, which are outlined in Table F5.2.

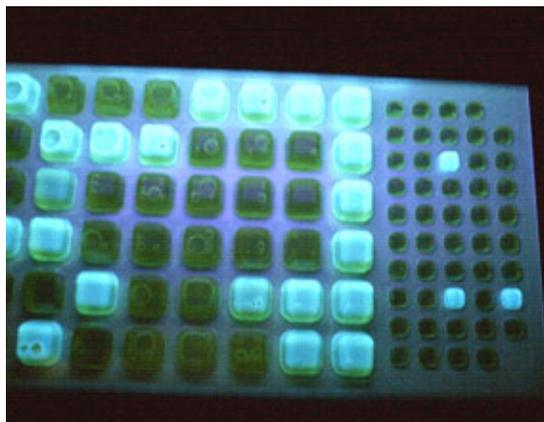


Figure F5.3: IDEXX Results

Table F5.2: Special Safety and Waste Management Considerations			
Indicator Parameter	Method	Major Health Risks	Special Disposal Requirements
Detergents – Surfactants	Chemetrics Chemets	Carcinogenic. Causes dermatitis and lung infection. Need to provide ventilation.	Hazardous Waste
<i>E. coli</i> ; Total Coliform; Enterococci	IDEXX: Colilert Or Enterolert	OK	Potential Biohazard (Consult State Health Agency for requirements)
Fluoride	HACH Method 8029	Causes erosion of teeth.	Reagent is a hazardous waste.
Hardness	HACH Method 8213	No major	Reaction produces a hazardous waste.

TIP

The IDEXX technique requires a special adaptation when used to measure *E. coli* in discharges from storm drain outfalls. The concentration that distinguishes sewage from other discharges is greater than 12,000MPN/100ml. Using this method, the maximum readable concentration is only 2,619MPN/ml. Dilute outfall samples to 10-20% of their original concentrations with deionized water in order to read the very high concentrations of *E. coli* that identify sewage discharges.

References

- Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems*. IDDE Project Support Material.
- Pitt, R. 2001. *Methods for Detection of Inappropriate Discharges to Storm Drainage Systems: Background Literature and Summary of Findings*. IDDE Project Support Material.
- Sargent, D. and W. Castonguay. 1998. *An Optical Brightener Handbook*. Prepared for: The Eight Towns and the Bay Committee. Ipswich, MA. Available at: <http://www.naturecompass.org/8tb/sampling/index.html>

APPENDIX G

SAMPLING PROTOCOL CONSIDERATIONS

Developing a Consistent Sample Collection Protocol

A good field sampling protocol incorporates eight basic elements:

1. Where to collect samples
2. When to collect samples
3. Sample bottle preparation
4. Sample collection technique
5. Storage and preservation of samples
6. Sample labeling and chain of custody plan
7. Quality assurance/control samples
8. Safety considerations

1. Where to Collect Samples

Indicator sampling normally occurs at three principle locations in the storm drain system to detect illicit discharges - at the outfall, in the stream, and within the storm drain pipe network.

Monitoring of dry weather flows from outfalls is the most common location in most IDDE programs, and the majority of this chapter focuses on these techniques.

In-stream monitoring involves sample collection at perennial stream channels during dry weather flow conditions. Stream monitoring is less precise than outfall monitoring at detecting individual discharges. It can, however, screen stream reaches for those with the greatest illicit discharge potential, detect the most severe or high volume discharges, and measure progress over time in terms changes in stream water quality.

In-pipe sampling is often needed to track down and isolate individual discharges once a potential discharge problem is encountered at an outfall. Many of the sample collection protocols discussed in this section can be applied for in-pipe sampling, although

additional testing methods to track down sources are described in Chapter 13.

2. When to Collect Samples

Indicator samples should be collected during dry weather periods to avoid flowing outfalls caused by storm water or groundwater infiltration. While the traditional definition of dry weather has been 72 hours without rainfall, some communities have shortened this window to 48 hours to make sampling more practical. An exception to this rule is sampling to respond to hotline complaints, which should be conducted immediately. Time of day that sampling is conducted is particularly important when the suspected source is residential sewage. Peak water usage occurs in the morning and evening, therefore sampling in the early morning (i.e., beginning of the work day) is recommended in these situations. In some regions of the country, sampling should be scheduled to coincide with the seasons where shallow groundwater influence is minimal.

3. Sample Bottle Preparation

Most indicator samples are stored in a polyethylene plastic sample bottle that is opaque or clear. Sample bottles can be reused, but only if they are acid-washed between field visits. If bacteria samples are collected, a new 120 ml sealed sample bottle is needed for each sample. Samples requiring a preservative are addressed in element 5.

4. Protocols for Sample Collection

Sample collection should reduce the potential for contamination, and prevent the field crew from being exposed to harmful

pollutants. Some considerations for sample collection include:

- Wear surgical gloves (unpowdered nitrile gloves are recommended to limit chances of contamination) when collecting the sample, and wash hands with sanitary wipes after the sample(s) is collected.
- Dry weather flows can be shallow, have low flow volumes, and be hard to reach. In some cases, alternative sample collectors may be used. A “dipper,” consisting of a measuring cup at the end of a long pole, can be used to catch flows from the outfall. A pre-measured, cut-off plastic milk jug can be used to capture shallow flows from the pipe (see Figure G.1). In either case, make sure not to disturb any sediments or benthic growth in the pipe as a sample is taken. Also, be sure to rinse these alternative sample collectors three times with sample water before collecting the sample.
- Fill the bottle completely to the top (i.e., with the meniscus at the rim).
- Do not touch the inside of the lid or bottle.

- Add any needed preservative at the time of sample collection. (See Step 5).
- Label the bottle immediately. Ensure that samples stay at 4°C (40°F). On a hot day, put samples in an ice-filled cooler immediately, or carry “blue ice” in a backpack.

5. Sample Storage and Preservation

If the field crew cannot get the samples back for analysis within the same day, they will need to preserve the samples using the techniques outlined in Table G.1. Some suppliers and contract labs provide pre-packaged sample bottles that contain required preservatives. Each indicator parameter has a unique sample preservation technique and a maximum hold time for laboratory analysis.

Tip

When analyzing multiple parameters and preserving samples, the field crew may need to collect up to four samples at a site: one preserved with H_2SO_4 , one preserved with HNO_3 , one sealed new bottle preserved with Na_2SO_3 for bacteria, and one unpreserved.



Figure G.1: A dipper (a) is helpful when the outfall is hard to reach. A milk jug (b) can be used to collect samples from shallow flow.

Table G.1: Sample Preservation and Storage Requirements for Typical Outfall Monitoring Parameters <i>(Primary Source: APHA, 1998)</i>		
Parameter	Preservation ³	Maximum Hold Time ⁴
Ammonia	H ₂ SO ₄ to pH<2 Refrigerate to 4°C	7 to 28 days
Boron	HNO ₃ to pH<2	28 days to 6 months
Chlorine ¹	Not Applicable	15 minutes
Color	Refrigerate to 4°C	48 hours
Conductivity	Refrigerate to 4°C	28 days
Detergents – Surfactants ²	None Required	48 hours
Bacteria (<i>E. coli</i> , Enterococci, Total Coliform) ²	Na ₂ S ₂ O ₃ in chlorinated waters Refrigerate to 4°C	6 to 24 hours
Fluoride	None Required	28 days
Hardness	HNO ₃ or H ₂ SO ₄ to pH<2	6 months
pH ¹	Not Applicable	15 minutes
Potassium ²	HNO ₃ to pH<2	28 days
Turbidity	Refrigerate to 4°C Store in the dark	24-48 hours
1. Indicates parameters that should be analyzed in the field. 2. Data for these parameters taken from the National Environmental Methods Index (www.nemi.gov) 3. Many contract labs will provide sample bottles with preservative already added. 4. For parameters with a range, the lower number is recommended by the reference, and the higher number is the regulatory requirement for sample storage.		

6. Sample Labeling and Chain of Custody

The labeling and integrity of each sample are important parts of the sampling protocol. Program managers should develop a process to track the “chain of custody” from the time

the sample is initially collected until it is analyzed and reported as data. The process limits errors resulting from mis-labeling, lost samples, and improper laboratory analysis. Table G.2 outlines the nine minimum elements of a chain of custody, recommended by APHA (1998).

Table G.2: Nine Elements of a Chain of Custody	
Element of Chain of Custody	Description
1. Sample Labels	Labels should include a unique ID, type of sample, name of collector, date and time of collection, date and time of preservation, and preservative used (if applicable).
2. Sample Seals	Seals the lid on the label to ensure they are not tampered with.
3. Field Log Book	Includes basic information about sample collection, usually the Outfall Reconnaissance Inventory (ORI) field form can be used for this purpose.
4. Chain-of-Custody Record	A sheet that tracks the transfer of samples between individuals.
5. Sample Analysis Request Sheet	A sheet that requests specific analysis types from the laboratory.
6. Sample Delivery to the Laboratory	Ensure that sample delivery is timely. Include chain of custody records with the sample.
7. Receipt and Logging of Sample	The lab needs to document time of receipt of the sample
8. Assignment of Sample for Analysis	The lab supervisor assigns an analyst to the sample. The lab supervisor or analyst is responsible at this point.
9. Disposal	Save samples until results are confirmed and finalized. Dispose of according to US EPA approved methods.

7. Quality Assurance Measures During Sample Collection

To ensure sampling results are accurate, it is important to institute quality assurance measures as part of the sampling protocol. Quality assurance samples serve as a check against biases introduced during sample collection, or within the laboratory. Quality assurance samples also assess the accuracy of the analysis method and its consistency for samples collected at the same site. The sampling protocol should define a minimum fraction of samples that will be used for quality assurance purposes (typically about 5% - 10% of all samples collected). Examples of quality assurance samples include field blanks, duplicate samples, split samples and spiked samples, which are described below:

Field Blanks – Field blanks are deionized water samples prepared in the field at the time of sample collection. If the lab results for field blanks have non-zero values, it indicates that impurities were introduced to

the sample during collection or lab analysis. The distilled deionized water should be placed in whatever is used to collect samples (e.g., sample scoop, dipper, plastic milk bottle) and then poured in the sample bottle, just as if it had been scooped or dipped as a real sample.

Duplicate (Replicate) Samples – This quality assurance technique relies on the collection of two or more samples from the same location and flow source during the same field visit. A discrepancy between the two sample measurements indicates a lack of precision or repeatability introduced during sample collection or lab analysis.

Field Spikes – A field spike is a sample to which a known concentration of an indicator parameter is added (e.g., an ammonia concentration of 1.0 mg/L). Any difference between the known concentration and the final laboratory measurement reveals errors introduced during sampling and laboratory analysis.

Split Samples – Splits consist of a single field sample that is divided into two separate sub-samples for subsequent laboratory analysis. Typically, split samples are submitted to different laboratories, or analyzed by different analysts to determine the precision of laboratory results.

Alternatively, split samples can be analyzed at a single laboratory without knowledge of the sample origin (referred to as a “blind sample”). Any discrepancy between the two sub-samples suggests a lack of precision or repeatability introduced during sample collection or lab analysis.

8. Safety Considerations

Whenever sampling is done there are safety considerations that require planning. This is even more important when sampling is being conducted in urban stream environments where there is potential for contact with contaminated water, sharp debris and objects, and threatening individuals (both animals and humans). Field crews should be comprised of at least two individuals, each equipped with proper foot (e.g., sturdy boots or waders) and hand wear (latex gloves). Key equipment for crews to carry include cell phones, a list of contact and emergency numbers, a gps unit, and a first aid kit. Private properties should not be accessed unless proper notification has been provided, preferably in advance. Lastly, program managers may want to consider requiring/recommending field crews to be vaccinated against Hepatitis B, particularly if the crews will be accessing waters known to be contaminated with illicit sewage discharges.

References

American Public Health Association (APHA).1998. *Standard Methods for the Examination of Water and Wastewater – 20th Edition*. Washington, D.C.

APPENDIX H
TWO ALTERNATIVE FLOW CHARTS

Appendix H: Two Alternative Flow Charts

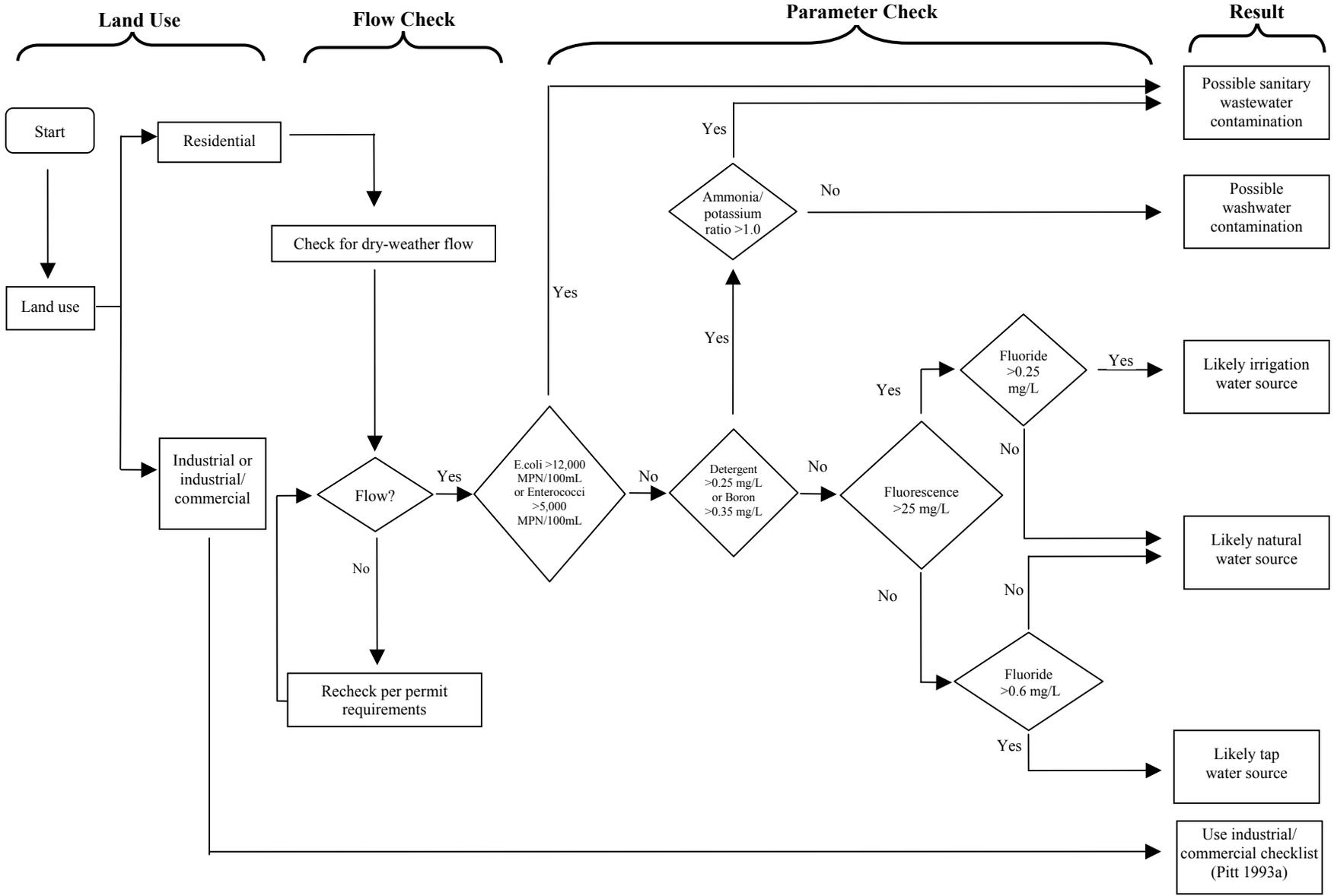
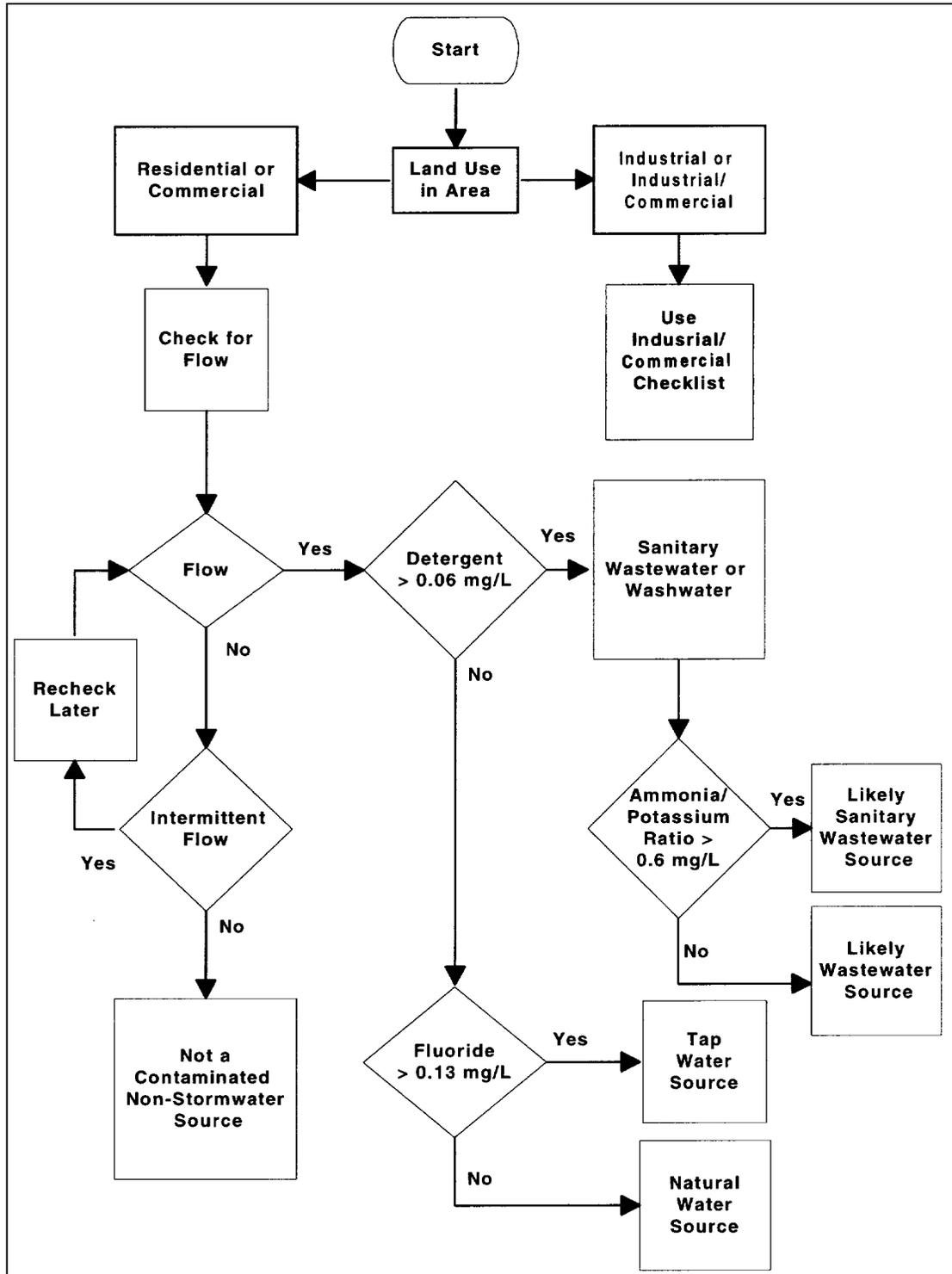


Figure H.1 Complete Flow Chart (Including Additional Confirmatory Parameters) from Tuscaloosa, Alabama
 Source: Pitt (2004)

Figure H.2 Original Flow Chart Derived from Data in Birmingham
(Pitt and Lalor, 1993)



References

Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems*. IDDE Project Support Material.

Pitt, R. and M. Lalor. 1993. *A User's Guide for the Assessment of Non-Stormwater Dischargers Into Separate Storm Drainage Systems*. EPA/600-R-92-238. Risk Reduction Engineering Laboratory, USEPA. Cincinnati, OH.

Appendix H: Two Alternative Flow Charts

APPENDIX I

USER'S GUIDE FOR THE CHEMICAL MASS BALANCE MODEL VERSION 1.0

(Adapted from Karri, 2004)

Overview of the Model

The Chemical Mass Balance Model (CMBM) estimates the most likely source components that contribute to outfall flows during dry weather. In order to use the model, the user must have a Library File in the form of an Excel file in a specified format. This library file describes the concentration characteristics of potential local contributing flows. In the CMBM, the user selects the sources to be evaluated for an outfall, enters the values of the concentrations of the tracers measured at the outfall, and obtains a plot of the most likely source component in tabular form, and in probability plots.

Installation of the Model

The user must first install the model by inserting the disk and then clicking the 'CMBM_setup.exe' icon and following the on-screen instructions.

Model Inputs

The user enters the following data:

1. The potential sources to be evaluated for a particular outfall. The number of sources is entered in the first form (Figure I.1) and the user must then select the same number of sources and tracers when the lists of the sources and tracers are loaded.
2. The source library file containing source flow characteristics (median, COV, and distribution type) for the Monte Carlo statistical simulations (Figure I.2).
3. The tracer parameters for these sources and outfall contained in the

library file. The user selects the specific tracers to be used from the check boxes when they are loaded in the first form.

4. The number of Monte Carlo simulations that are to be used by the model, up to 10,000 runs.
5. The observed outfall concentrations of the selected tracer parameters measured for a particular outfall (in the second form of the model). Press the continue button when these concentrations are entered.

In the first form

- Navigation from one step to another can be done by using either the mouse or the 'tab' button.
- Changing the value entered for 'Number of contributing sources to be evaluated' after entering subsequent steps will likely result in an error message. If the user wishes to change this value after starting on later forms, the user must use the 'Start over again' button (third form) and re-enter the earlier forms.
- The model can run up to eight sources and tracers in a single trial.

In the third form

- The user must first save the output file to run the Monte Carlo simulation.
- The user must first save the graph to view or print it.
- The user must first save the table to print it.
- If the table cannot be viewed properly, it can be resized.

1. Enter Number of Contributing Sources to be Evaluated 2. Click to Select Library File

3. Enter Number of Monte Carlo runs for the evaluation [≤ 10000] 4. Click to Select Sources and Tracers

5. Select Sources

- Tap Water
- Spring Water
- Carwash Wastewater
- Laundry Wastewater
- Sewage Wastewater
- Irrigation Water

6. Select Tracers

- Conductivity ($\mu\text{mhos/cm}$)
- Fluoride (mg/L)
- Hardness (mg/L) CaCO₃
- Detergent (mg/L)
- Fluorescence (mg/L as Tide)
- Potassium (mg/L)
- Ammonia (mg/L)
- Color (Units)
- Turbidity (NTU)
- Boron (mg/L)
- E-Coli (MPN)
- Enterococci (MPN)

7. Click to Continue to Next Step

Figure I.1: Form-1 (Model inputs)

8. Enter Observed Outfall Tracer Concentrations

Conductivity ($\mu\text{mhos/cm}$)	<input type="text" value=""/>
Fluoride (mg/L)	<input type="text" value="0.97"/>
Hardness (mg/L) CaCO ₃	<input type="text" value=""/>
Detergent (mg/L)	<input type="text" value="0.25"/>
Fluorescence (mg/L as Tide)	<input type="text" value="02.82"/>
Potassium (mg/L)	<input type="text" value="2"/>
Ammonia (mg/L)	<input type="text" value="8"/>
Color (Units)	<input type="text" value="0"/>
Turbidity (NTU)	<input type="text" value=""/>
Boron (mg/L)	<input type="text" value=""/>
E-Coli (MPN)	<input type="text" value=""/>
Enterococci (MPN)	<input type="text" value=""/>

9. Click to Continue to Next Step

Figure I.2: Form-2 (Model inputs)

Model Outputs

The output of the model is in two forms:

- A summary table lists the 95th percentile confidence interval (the 2.5th and the 97.5th percentile values) and the 50th percentile (median) values of the mass fraction for each source contributing to the outfall dry weather flow, as calculated by the CMBM and using the number of Monte Carlo simulations specified. This table also shows these values for an error term, μ (Mu):* This table
- A probability plot of the calculated mass fractions for each selected source flow and also for the error term, μ (Mu):* This plot (see Figure I.3) can be saved and printed by selecting the options in the third form. In order to print each figure, they must first be selected and saved on the computer.

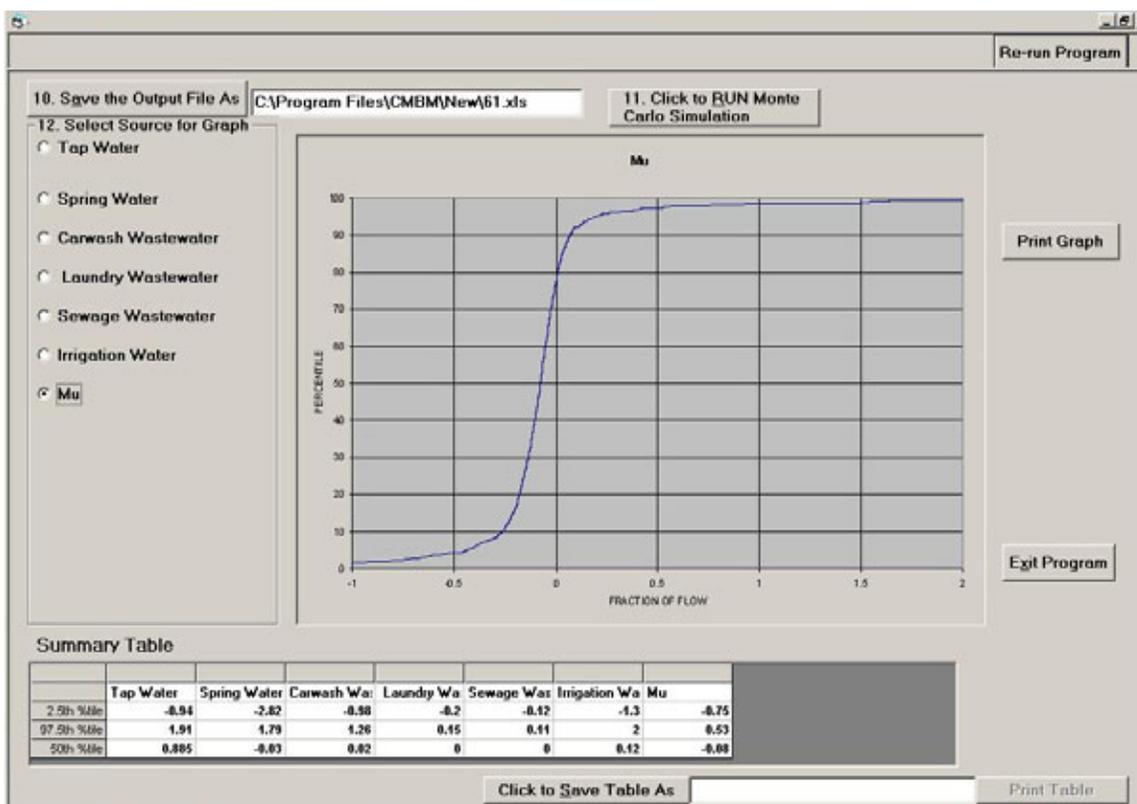


Figure I.3: Form-3 (Model output)

Library File Format

This model recognizes the source file for evaluation, only when it is in a specific format in an Excel spreadsheet.

- The data for each source is entered in an Excel file, with a separate worksheet being used for each individual source. Worksheets should be named according to the source (e.g., tap water, spring water, sewage, etc.)
- The first column of the Excel data sheet must contain the names of the tracers, starting with the second row, the second column must contain values of mean concentration, the third column, the coefficient of variation, and the fourth column the type of distribution. “N” is for “normal”, or Gaussian, distributions, while “L” if for log-normal distributions. Figure I.4 is an example spreadsheet file for source area library flows.

Tracer	Mean Concentration	COV	Distribution
Conductivity (µmhos/cm)	274.67	0.46	N
Fluoride (mg/L)	1.23	1.57	L
Hardness (mg/L) CaCO ₃	71.17	0.27	N
Detergent (mg/L)	140.91	0.21	N
Fluorescence (mg/L as Tide)	90.98	0.47	N
Potassium (mg/L)	3.58	0.67	L
Ammonia (mg/L)	0.90	1.42	L
Color (Units)	100.00	0.01	N
Turbidity (NTU)	156.81	0.78	N
Boron (mg/L)	0.65	0.74	L
E-Coli (MPN)	100.00	0.00	L
Enterococci (MPN)	10.00	0.00	L

Figure I.4: Excel Sheet in Library File

Example Problems

Example 1

This first example illustrates a verification procedure that is used to ensure the model is functioning as expected. It assumes the analysis of an undiluted flow.

Consider an outfall, which has the same data for the tracer parameters as were observed at the sewage treatment plant (which is the same as the library data for sewage wastewater). This means that the model must predict the most likely source component to be sewage and with a predicted fraction of flow for sewage close to one.

The library file used here is the Birmingham library file 'Library_BHM.xls' (which is included with the program). Let the number of Monte Carlo simulations considered be 1000, and the number of sources selected for evaluation be 4 (sewage wastewater, tap water, spring water, and landscape irrigation runoff). The tracers selected are

conductivity, fluoride, potassium and ammonia. Figure I.5 shows these corresponding entries, while Figure I.6 shows the Excel spreadsheet for the library file used.

Figure I.7 shows the entries made in the second form. It should be noted that the values for the tracers entered are the same as those in the library file for sewage.

Figure I.8 shows the output form. The 50th percentile value for Sewage Wastewater flow in the summary table is 1.06, while the 95 percent confidence interval is 0.54 to 2.2. This table shows that the most likely source at the outfall is Sewage Wastewater, which is the same as the initial assumption. Also, the fraction of flow that is sewage is 1.06, very close to 1.0. Also, the sum of all 50th percentile flow contributions is 0.98, also very close to 1.0, indicating good agreement. The potential mass contributions for the other source flows are also close to zero.

Figure I.5: Form 1 (Input for Example 1)

Tracer	Median Concentration	COV	Distribution
Conductivity ($\mu\text{mhos/cm}$)	419.86	0.13	N
Fluoride (mg/L)	0.76	0.23	N
Hardness (mg/L CaCO_3)	142.92	0.11	N
Detergent (mg/L)	1.5	0.82	N
Fluorescence (mg/L)	250.89	0.2	N
Potassium (mg/L)	5.97	0.23	N
Ammonia (mg/L)	9.92	0.34	L
Color (mg/L)	37.89	0.55	N

Figure I.6: Library File Excel Sheet (Sewage Wastewater)

8. Enter Observed Outfall Tracer Concentrations

Conductivity ($\mu\text{mhos/cm}$) 419.86

Fluoride (mg/L) 0.76

Hardness (mg/L CaCO_3)

Detergent (mg/L)

Fluorescence (% scale)

Potassium (mg/L) 5.97

Ammonia (mg/L) 9.92

Color (units)

9. Click to Continue to Next Step

Figure I.7: Form 2 (Input)

10. Save the Output File As C:\CMIMM\Example_1.xls

11. Click to [RUN Monte Carlo Simulation]

12. Select Source for Graph

Spring Water

Tap Water

Sewage Wastewater

Landscape Irrigation Water

Mu

Sewage Wastewater

Print Graph

Exit Program

Summary Table

	Spring Water	Tap Water	Sewage Ww	Landscape Ir	Mu
2.9th Node	-3.29	-4.2	8.52	-3.17	-3.2
97.9th Node	8.93	4.38	2.89	8.79	8.89
50th Node	-8.88	8.88	1.86	-8.825	-8.81

Click to Save Table As

Print Table

Figure I.8: Form 3 (Output for Example 1)

Example 2

In this example, eight possible source types and eight tracer parameters are selected, based on sample data from outfall # 20 in Birmingham, AL, collected on March 3, 1993.

The library file used in this example is also the Birmingham library file: 'Library_BHM.xls'. Let the number of Monte Carlo simulations be 1000, the number of sources selected for evaluation be 7 (spring water, tap water, sewage wastewater, commercial carwash wastewater, landscape irrigation water, infiltrating groundwater, and septic tank discharge). The seven tracers selected are

conductivity, fluoride, hardness, detergents, fluorescence, potassium, and ammonia.

Figure I.9 shows all the corresponding entries using this information. Figure I.10 shows the entries made in the second form. Figure I.11 shows the output form. The fraction of flow as indicated for the 50th percentile value for tap water on the summary table is the highest value (0.72) compared to the other potential source flows. This indicates that the most likely source at the outfall is tap water, as verified through field observations. The spring water mass fraction is also relatively high (0.42), indicating that this source water may also be present.

Figure I.9: Form 1 (Input for Example 2)

8. Enter Observed Outfall Tracer Concentrations

Conductivity (µmhos/cm) 188

Fluoride (mg/L) 0.61

Hardness (mg/L CaCO₃) 127

Detergent (mg/L) 0

Fluorescence (% scale) 13

Potassium (mg/L) 1.98

Ammonia (mg/L) 0.03

Color (units) [Blank]

9. Click to Continue to Next Step

Figure I.10: Form 2 (Input for Example 2)

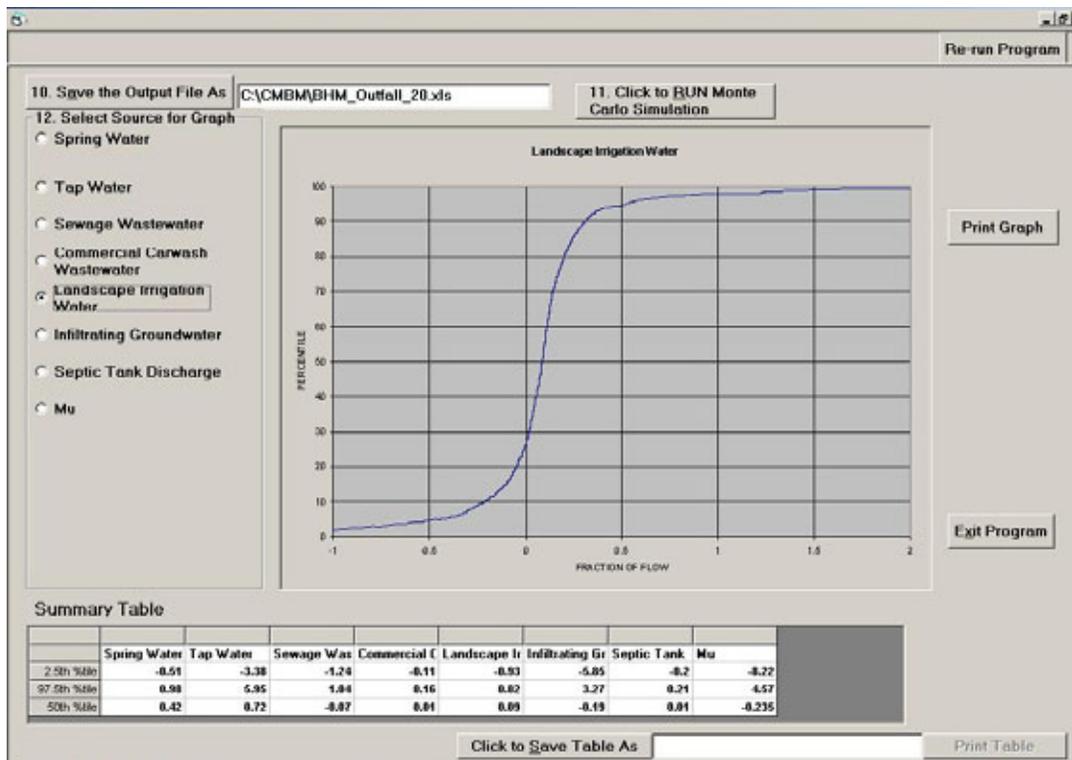


Figure I.11: Form 3 (Output for Example 2)

APPENDIX J

USING THE CHEMICAL LIBRARY TO DETERMINE THE UTILITY OF BORON AS AN INDICATOR OF ILLICIT DISCHARGES

Introduction

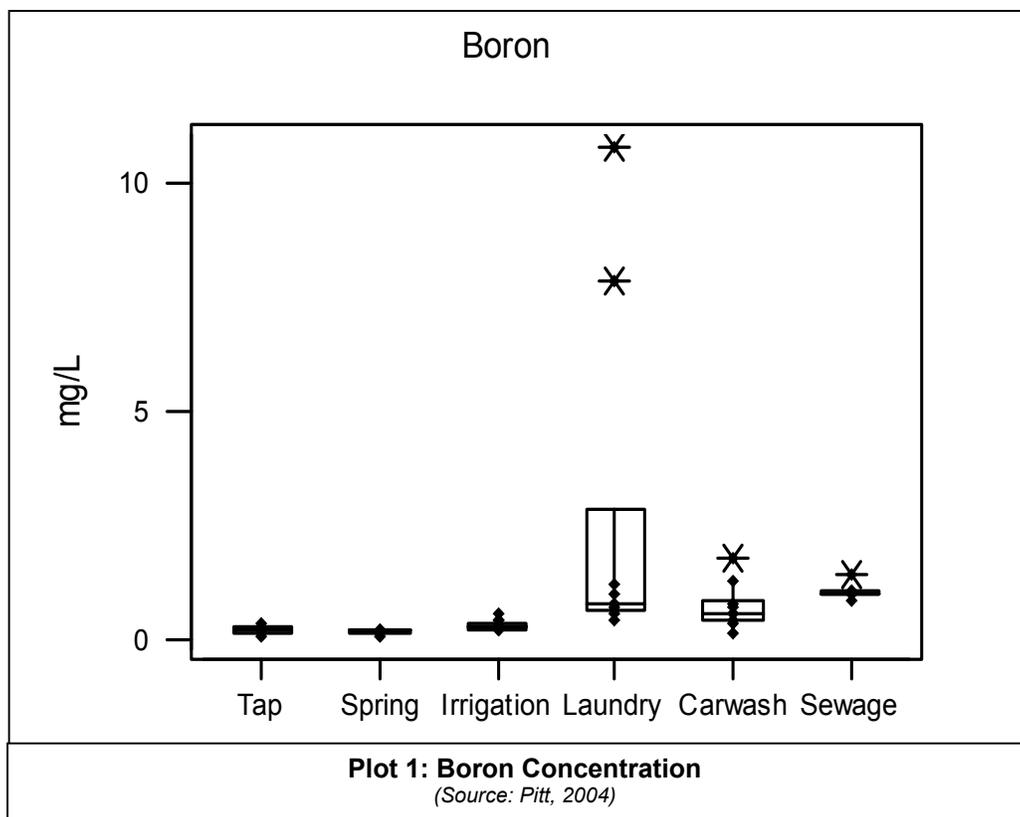
In this example, library data from several flow types are analyzed to determine a good cut-off point to use boron as an indicator of illicit discharges. Both the data and the selected concentrations are derived from research in Tuscaloosa, Alabama (Pitt, 2004). Investigators examined the data from their chemical flow library both graphically and then in detail to select a concentration.

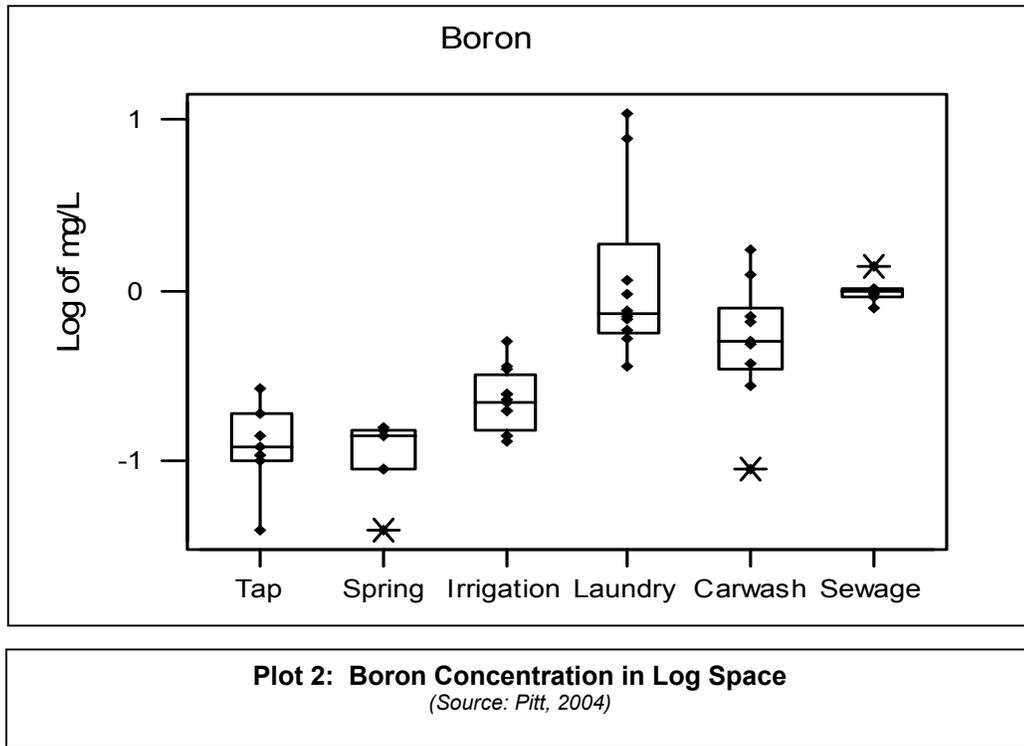
Step 1: Visually Analyze Data Using Box Plots

After collecting data from a select group of flow types, researchers assembled the data into box plots (see Plots 1 and 2). These plots help quickly identify the range of data. The “box” portion of the plot shows the first

quartile, median, and third quartile for the data, and the individual data points show the data above and below this range.

A first look at the data shows that sewage, laundry, and wash water sources all have a higher concentration than the non-illicit flows: irrigation, tap water, and spring water. A closer look, using the log plot (i.e., the log of each concentration), shows some overlap between irrigation water and two of the illicit flow types: laundry and car wash. Although this overlap means that there will be some “false negatives” or “false positives” using this parameter, investigators select a concentration that is lower than the lowest concentration in laundry. This value appears to be somewhere between $10^{-0.5}$ (or 0.3 mg/L) and 10^0 (or 1.0 mg/L).





Step 2: Evaluate Tabular Data

The first step is a good general indicator of how to use boron as an indicator. The second step refines the initial evaluation to come up with a specific value to use as an indicator, and a numeric estimate of the number of “false positives” (i.e., identifying a non-illicit flow as illicit) and “false negatives” (i.e., identifying an illicit flow as non-illicit) that would result from using the

parameter. (See Table below for the data used in this investigation).

Using data from the three sources with overlap, investigators select a concentration of >0.35 mg/L as an indicator of sewage or wash water. (This value captures all laundry flows). Using this value, two of 12 irrigation samples are identified as illicit (a 17% false positive rate) and two of 10 car wash samples are not captured as an illicit discharge (a 20% false negative rate).

Boron Concentration (mg/L) For Six Flow Types (Concentrations >0.35 mg/L indicate illicit discharges)					
Tap Water	Spring Water	Irrigation	Laundry	Car Wash	Sewage
0.04	0.04	0.13	0.36	0.09	0.78
0.1	0.09	0.14	0.53	0.28	0.93
0.11	0.09	0.14	0.58	0.37	0.97
0.12	0.14	0.2	0.67	0.48	0.98
0.14	0.15	0.2	0.7	0.5	1.01
0.19	0.15	0.22	0.75	0.5	1.05
0.27	0.16	0.23	0.97	0.65	1.38
		0.25	1.16	0.7	
		0.25	7.9	1.23	
		0.35	10.8	1.74	
		0.36			
		0.5			
Yellow shading indicates a false positive.					
Pink shading indicates a false negative.					
Source: Pitt (2004)					

Step 3: Make a Determination

Based on these data, boron shows high promise as an indicator of illicit discharges. It correctly categorizes all flows from tap water, spring water, laundry and sewage, and has fairly low false positive or negative rates for identifying irrigation and car wash

discharges. One potential concern, however, is that dilution occurring at the outfall may mask some illicit discharges. For example, a 50% dilution with spring water (using the median concentration of 0.14 mg/L) would result in a 20% false negative rate for laundry waters and a 60% false negative for car wash waters.

VERDICT: GOOD CANDIDATE FOR FLOW CHART METHOD. NEEDS FIELD TESTING!

References

Pitt, R. 2004. *Methods for Detection of Inappropriate Discharge to Storm Drain Systems*. IDDE Project Support Material.

APPENDIX K

SPECIFIC CONSIDERATIONS FOR INDUSTRIAL SOURCES OF INAPPROPRIATE POLLUTANT ENTRIES TO THE STORM DRAINAGE SYSTEM

(Adapted from Pitt, 2001)

Industrial Site Surveys

Additional pollutants associated with local commercial and industrial activities need to be monitored during outfall screening activities if these activities exist in the watersheds of interest. This monitoring will assist in identifying the classes of commercial or industrial activities responsible for the contamination. The first step in this process is to identify which industrial and commercial activities may contribute non-storm water discharges to the drainage system. The review of industrial user surveys or reports that are available needs to be done initially. It may be necessary to also send a questionnaire to industries in the watershed that are draining to the storm drainage system to identify the specific activities that may affect runoff quality and dry weather discharges. Site inspections will still be required because questionnaires may not be returned or may give incorrect details (either deliberately or unknowingly).

Industrial areas are known to contribute excessive wet-weather storm water discharges, along with contaminated dry weather entries into the storm drainage system. Therefore, additional industrial site investigations are needed to identify activities that most obviously contribute these contaminants to the storm drainage system. Figure K.1 is an example industrial site survey form prepared by the Non-Point Source and Land Management Section of the Wisconsin Department of Natural Resources (Bannerman, 2003). This form has been used to help identify industrial activities that contribute dry- and wet-weather non-storm water entries into the storm drainage system.

This form only considers outside sources that would affect the storm drainage system by entering through inlets or through sheetflow runoff into drainage channels. This sheet does not include any information concerning indoor activities, or direct plumbing connections to the storm drainage system. However, the information included on this sheet can be very helpful in devising runoff control programs for industrial areas. This information most likely affects wet-weather discharges much more than dry weather discharges. Obvious dry weather leaching or spillage problems are also noted on the form.

Table K.1 presents the types of activities in industrial areas that may contribute dry weather discharges to storm drainage systems. This table can be used to rank the most likely industries that may produce non-storm water discharges to a storm drainage system in an area. This table is used in conjunction with the industrial site survey form to catalog specific activities in the watershed that may need correction. After a listing of the candidate activities is known in the watersheds, additional tracer parameters may then be selected to add to the screening efforts.

Likely Dry Weather Discharge Characteristics for Different Industries

Chemical and Physical Properties

Table K.1 summarizes possible chemical and physical characteristics of non-storm water discharges, which could come from various industries. The properties considered are pH, total dissolved solids, odor, color, clarity, floatable materials, vegetation, and structural damage potential. The descriptions in each of these categories contain the most likely conditions for a non-storm water discharge coming from a

particular industry. It should be noted that a combination of just a few of these characteristics, or perhaps all of them, might occur at an outfall affected by a potential source. In addition, outfalls are likely to be affected by several sources simultaneously, further confusing the situation. Again, a

complete watershed analysis describing the industrial and commercial facilities operating in each outfall watershed will be of great assistance in identifying which industries may be contributing harmful dry weather discharges to the storm system.

City: _____ Industry Name: _____
 Site Number: _____ Photo # _____
 Street Address: _____ Roll# _____
 Type of industry: _____
 Instructions: Fill in blanks or circle best answer in following (use back of sheet if necessary):

Material/waste Storage Areas

1. Type of material/waste: _____
2. Method of storage: pile tank dumpster other: _____
3. Area occupied by material/waste (acres): _____
4. Type of surface under material/waste: paved unpaved
5. Material/waste is disturbed: often sometimes never unsure
6. Description of spills (material, quantity & frequency): _____
7. Nearest drainage (feet) and drainage type: _____
8. Control practice: berm tarp buffer none other: _____
9. Tributary drainage area, including roofs (acres): _____
10. Does storage area drain to parking lot: yes no unsure

Heavy equipment storage

1. Type of equipment: _____
2. Area covered by equipment (acres): _____
3. Type of surface under equipment: paved unpaved
4. Nearest drainage (feet) and drainage type: _____
5. Control practice: berm tarp buffer none other: _____
6. Tributary drainage area, including roofs (acres): _____
7. Does storage area drain to parking lot: yes no unsure

Air pollution

1. Description of settleable air pollutants (types & quantities): _____
2. Description of particulate air pollutant controls: _____

Railroad yard

1. Size of yard (number of tracks): _____
2. General condition of yard: _____
3. Description of spills in yard (material, quantity & frequency): _____
4. Type of surface in yard: paved unpaved
5. Nearest drainage (feet) and drainage type: _____
6. Type of control practice: berm buffer other: _____
7. Does yard drain to parking lot: yes no unsure
8. Tributary drainage area, including roofs (acres): _____

Loading Docks

1. Number of truck bays: _____
2. Type of surface: paved unpaved
3. Description of spills in yard (material, quantity & frequency): _____
4. Nearest drainage (feet) and drainage type: _____
5. Type of control practice: berm buffer other: _____
6. Does loading area drain to parking lot: yes no unsure
7. Tributary drainage area, including roofs (acres): _____

Figure K.1: Industrial Inventory Field Sheet

Source: (Source: *Bannerman, 2003*)

Appendix K: Specific Considerations for Industrial Sources

Table K.1: Chemical and Physical Properties of Industrial Non-Storm Water Discharges									
Industrial Categories Major Classifications SIC Group Numbers	Odor	Color	Turbidity	Floatables	Debris and Stains	Structural Damage	Vegetation	pH	Total Dissolved Solids
Primary Industries									
20: Food and Kindred Products									
201 Meat Products	Spoiled Meats, Rotten Eggs and Flesh	Brown to Reddish-Brown	High	Animal Fats, Byproducts, Pieces of Processed Meats	Brown to Black	High	Flourish	Normal	High
202 Dairy Products	Spoiled Milk, Rancid Butter	Gray to White	High	Animal Fats, Spoiled Milk Products	Gray to Light Brown	High	Flourish	Acidic	High
203 Canned and Preserved Fruits and Vegetables	Decaying Products Compost Pile	Various	High	Vegetable Waxes, Seeds, Skins, Cores, Leaves	Brown	Low	Normal	Wide Range	High
204 Grain Mill Products	Slightly Sweet & Musty, Grainy	Brown to Reddish Brown	High	Grain Hulls and Skins, Straw & Plant Fragments	Light Brown	Low	Normal	Normal	High
205 Bakery Products	Sweet and or Spoiled	Brown to Black	High	Cooking Oils, Lard, Flour, Sugar	Gray to Light Brown	Low	Normal	Normal	High
206 Sugar and Confectionary Products	NA	NA	Low	Low Potential	White Crystals	Low	Normal	Normal	High
207 Fats and Oils	Spoiled Meats, Lard or Grease	Brown to Black	High	Animal Fats, Lard	Gray to Light Brown	Low	Normal	Normal	High
208 Beverages	Flat Soda, Beer or Wine, Alcohol, Yeast	Various	Mod.	Grains, Hops, Broken Glass, Discarded Canning Items	Light Brown	High	Inhibited	Wide Range	High
21: Tobacco Manufactures	Dried Tobacco, Cigars, Cigarettes	Brown to Black	Low	Tobacco Stems & Leaves, Papers and Fillers	Brown	Low	Normal	Normal	Low
22: Textile Mill Products	Wet Burlap, Bleach, Soap, Detergents	Various	High	Fibers, Oils, Grease	Gray to Black	Low	Inhibited	Basic	High
23: Apparel and Other Finished Products	NA	Various	Low	Some Fabric Particles	NA	Low	Normal	Normal	Low
Material Manufacture									
24: Lumber & Wood Products	NA	NA	Low	Some Sawdust	Light Brown	Low	Normal	Normal	Low
25: Furniture & Fixtures	Various	Various	Low	Some Sawdust, Solvents	Light Brown	Low	Normal	Normal	Low
26: Paper & Allied Products	Bleach, Various Chemicals	Various	Mod.	Sawdust, Pulp Paper, Waxes, Oils	Light Brown	Low	Normal	Wide Range	Low
27: Printing, Publishing, and Allied Industries	Ink, Solvents	Brown to Black	Mod.	Paper Dust, Solvents	Gray to Light Brown	Low	Inhibited	Normal	High
31: Leather & Leather Products	Leather, Bleach, Rotten Eggs or Flesh	Various	High	Animal Flesh & Hair, Oils, Grease	Gray to Black, Salt Crystals	High	Highly Inhibited	Wide Range	High
33: Primary Metal Industries	Various	Brown to Black	Mod.	Ore, Coke, Limestone, Millscale, Oils	Gray to Black	High	Inhibited	Acidic	High

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Industrial Categories Major Classifications SIC Group Numbers	Odor	Color	Turbidity	Floatables	Debris and Stains	Structural Damage	Vegetation	pH	Total Dissolved Solids
34: Fabricated Metal Products	Detergents, Rotten Eggs	Brown to Black	High	Dirt, Grease, Oils, Sand, Clay Dust	Gray to Black	Low	Inhibited	Wide Range	High
32: Stone, Clay, Glass, and Concrete Products	Wet Clay, Mud, Detergents	Brown to Reddish-Brown	Mod.	Glass Particles Dust from Clay or Stone	Gray to Light Brown	Low	Normal	Basic	Low
Chemical Manufacture									
28: Chemicals & Allied Products									
2812 Alkalies and Chlorine	Strong Halogen or Chlorine, Pungent, Burning	Alkalies – NA; Chlorine - Yellow to Green	Low	NA	Alkalies – White Carbonate Scale Chlorine - NA	High	Highly Inhibited	Basic	High
2816 Inorganic Pigments	NA	Various	High	Low Potential	Various	Low	Highly Inhibited	Wide Range	High
282 Plastic Materials and Synthetics	Pungent, Fishy	Various	High	Plastic Fragments, Pieces of Synthetic Products	Various	Low	Inhibited	Wide Range	High
283 Drugs	NA	Various	High	Gelatin Byproducts for Capsulating Drugs	Various	Low	Highly Inhibited	Normal	High
284 Soap, Detergents & Cleaning Preparations	Sweet or Flowery	Various	High	Oils, Grease	Gray to Black	Low	Inhibited	Basic	High
285 Paints, Varnishes, Lacquers, Enamels and Allied Products (SB - Solvent Base)	Latex - Ammonia SB - Dependent Upon Solvent (Paint Thinner, Mineral Spirits)	Various	High	Latex - NA SB - All Solvents	Gray to Black	Low	Inhibited	Latex-Basic SB - Normal	High
286 Indust. Organic Chemicals									
2861 Gum and Wood Chemicals	Pine Spirits	Brown to Black	High	Rosins and Pine Tars	Gray to Black	Low	Inhibited	Acidic	High
2865 Cyclic Crudes, & Cyclic Intermediates Dyes, & Organic Pigments	Sweet Organic Smell	NA	Low	Translucent Sheen	NA	Low	Highly Inhibited	Normal	Low
287 Agricultural Chemicals									
2873 Nitrogenous Fertilizers	NA	NA	Low	NA	White Crystalline Powder	High	Inhibited	Acidic	High
2874 Phosphatic Fertilizers	Pungent Sweet	Milky White	High	NA	White Emorphous Powder	High	Inhibited	Acidic	High
2875 Fertilizers, Mixing Only	Various	Brown to Black	High	Pelletized Fertilizers	Brown Emorphous Powder	Low	Normal	Normal	High
29: Petroleum Refining and Related Industries									
291 Petroleum Refining	Rotten Eggs, Kerosene, Gasoline	Brown to Black	High	Any Crude or Processed Fuel	Black Salt Crystals	Low	Inhibited	Wide Range	High

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30 Rubber & Miscellaneous Plastic Products	Rotten Eggs, Chlorine, Peroxide	Brown to Black	Mod.	Shredded Rubber Pieces of Fabric or Metal	Gray to Black	Low	Inhibited	Wide Range	High
Transportation & Construction									
15 Building Construction	Various	Brown to Black	High	Oils, Grease, Fuels	Gray to Black	Low	Normal	Normal	High
16 Heavy Construction	Various	Brown to Black	High	Oils, Grease, Fuels, Diluted Asphalt or Cement	Gray to Black	Low	Normal	Normal	High
Retail									
52 Building Materials, Hardware, Garden Supply, and Mobil Home Dealers	NA	Brown to Black	Low	Some Seeds, Plant Parts, Dirt, Sawdust, or Oil	Light Brown	Low	Normal	Normal	Low
53 Gen. Merchandise Stores	NA	NA	NA	NA	NA	Low	Normal	Normal	Low
54 Food Stores	Spoiled Produce, Rancid, Sour	Various	Low	Fragments of Food, Decaying Produce	Light Brown	Low	Flourish	Normal	Low
55 Automotive Dealers & Gasoline Service Stations	Oil or Gasoline	Brown to Black	Mod.	Oil or Gasoline	Brown	Low	Inhibited	Normal	Low
56 Apparel & Accessory Stores	NA	NA	Low	NA	NA	Low	Normal	Normal	Low
57 Home Furniture, Furnishings, & Equip. Stores	NA	NA	Low	NA	NA	Low	Normal	Normal	Low
58 Eating & Drinking Places	Spoiled Foods Oil & Grease	Brown to Black	Low	Spoiled or Leftover Foods	Brown	Low	Normal	Normal	Low
Coal Steam Electric Power	NA	Brown to Black	High	Coal Dust	Black Emorphous Powder	Low	Normal	Slightly Acidic	Low
Nuclear Steam Electric Power	NA	Light Brown	Low	Oils, Lubricants	Light Brown	Low	Normal	Normal	Low

Other Chemicals Indicative of Manufacturing Industrial Activities

Table K.2 lists the various chemicals that may be associated with a variety of different industrial activities. It may be possible to examine non-storm water outfall flow for specific chemicals, such as shown on this list to identify which specific manufacturing industrial activities may be contributing the flows.

Example Problems for Locating an Industrial Source

Locating An Industrial Source

Hypothetical examples have been created to demonstrate how dry weather discharges can be characterized so that their likely industrial sources can be identified. These examples show how observations of outfall conditions and simple chemical analyses, combined with a basic knowledge of wastewater characteristics of industrial and commercial operations located in the drainage area can be used to identify the possible pollutant sources. The initial activities include pollutant analyses of outfalls being investigated. This requires the characterization on the non-storm water flows, the identification of the likely industries responsible for the observed discharges, and finally, locating the possible specific sources in the watershed.

The industries identified in a hypothetical storm water drainage area (from the watershed analysis) included a vegetable cannery, general food store, fast food restaurant, cheese factory, used car dealer, cardboard box producer, and a wood treatment company. The methods used to determine the most likely industrial source of the dry weather discharges are considered

for three hypothetical situations of outfall contamination.

Case Example 1

The hypothetical results of the pollutant analysis for the first situation found constant dry weather flow at the outfall. The measurements indicated a normal pH (6) and low total dissolved solids concentrations (300 mg/L). Other outfall characteristics included a strong odor of bleach, no distinguishing color, moderate turbidity, sawdust floatables, a small amount of structural corrosion, and normal vegetation.

The significant characteristic in this situation is the sawdust floatables (see Figure K.2). The industries that could produce sawdust and have dry weather flow drainage to this pipe are the cardboard box company and the wood treatment company. According to their SIC codes, these companies would fall under the category of “Paper and Wood Products.” Looking up these two industries by their corresponding SIC group numbers in Table K.1 and comparing the listed properties indicates that the paper industry has a strong potential for the odor of bleach. Wood products does not indicate any particular smell.

Based upon these data, the most likely industrial source of the non-storm water discharge would be the cardboard box company. Table A.1 (Appendix A) indicates a high potential for direct connections at paper and wood product facilities. At this point, further testing should be conducted at the cardboard box company to determine if the constant source of contamination is coming from cooling waters, process waters, or direct piping connections (process waters are the most likely source, given the bleach and sawdust characteristics).

Table K.2: Significant Chemicals in Industrial Wastewaters	
Chemical	Industry
Acetic acid	Acetate rayon, pickle and beetroot manufacture
Alkalies	Cotton and straw kiering, cotton manufacture, mercerizing, wool scouring, laundries
Ammonia	Gas and coke manufacture, chemical manufacture
Arsenic	Sheep-dipping, fell mongering
Chlorine	Laundries, paper mills, textile bleaching
Chromium	Plating, chrome tanning, aluminum anodizing
Cadmium	Plating
Citric acid	Soft drinks and citrus fruit processing
Copper	Plating, pickling, rayon manufacture
Cyanides	Plating, metal cleaning, case-hardening, gas manufacture
Fats, oils	Wool scouring, laundries, textiles, oil refineries
Fluorides	Gas and coke manufacture, chemical manufacture, fertilizer plants, transistor manufacture, metal refining, ceramic plants, glass etching
Formalin	Manufacture of synthetic resins and penicillin
Hydrocarbons	Petrochemical and rubber factories
Hydrogen peroxide	Textile bleaching, rocket motor testing
Lead	Battery manufacture, lead mining, paint manufacture, gasoline, manufacture
Mercaptans	Oil refining, pulp mills
Mineral acids	Chemical manufacture, mines, Fe and Cu pickling, brewing, textiles, photo-engraving, battery manufacture
Nickel	Plating
Nitro compounds	Explosives and chemical works
Organic acids	Distilleries and fermentation plants
Phenols	Gas and coke manufacture; synthetic resin manufacture; textiles; tanneries; tar, chemical, and dye manufacture; sheep-dipping
Silver	Plating, photography
Starch	Food, textile, wallpaper manufacture
Sugars	Dairies, foods, sugar refining, preserves, wood process
Sulfides	Textiles, tanneries, gas manufacture, rayon manufacture
Sulfites	Wood process, viscose manufacture, bleaching
Tannic acid	Tanning, sawmills
Tartaric acid	Dyeing; wine, leather, and chemical manufacture
Zinc	Galvanizing, plating, viscose manufacture, rubber process

Source: Klein (1962). River Pollution 2: Causes and Effects. Butterworth & Co. presented in The Water Encyclopedia, D. Todd, Water Information Center, Port Washington, N.Y., 1979.

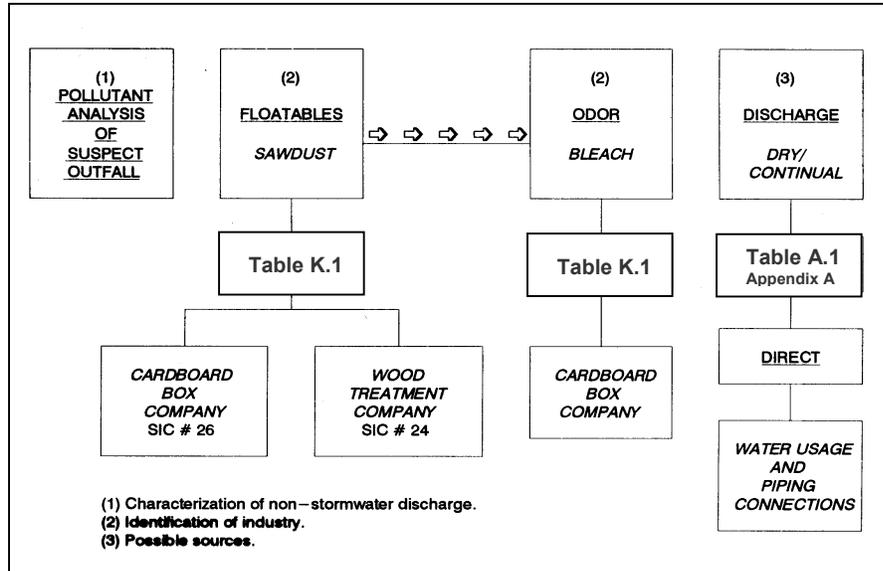


Figure K.2: Flowsheet for Case Example 1

Case Example 2

Pollutant analysis for the second situation found intermittent dry weather discharges at the outfall. The test measurements indicated an acidic pH (3) and high total dissolved solids concentrations (approximately 6,000 mg/L). Other characteristics included a rancid-sour odor, grayish color, high turbidity, gray deposits containing white gelatin-like floatable material, structural damage in the form of spalling concrete, and an unusually large amount of plant life.

The rancid-sour smell and the presence of floatable substances at this outfall indicate that some type of food product is probably spoiling. This narrows the possible suspect industries to the fast food restaurant, cheese factory, vegetable cannery, and food store (see Figure K.3). The corresponding SIC categories for each of these industries are “Eating and Drinking Places” (SIC# 58), “Dairy Products” (SIC# 202), “Canned and Preserved Fruits and Vegetables” (SIC# 203), and “Food Stores” (SIC# 54).

Comparison of the properties listed in Table K.1 for these SIC codes indicates that elevated plant life is common to industrial wastes for the “Dairy Products” and “Food Stores” categories. However, the deciding factor is the acidic pH, which is only listed for “Dairy Products”. Thus, the white gelatin-like floatables are most likely spoiled cheese byproducts from the cheese factory, which are also the probable cause of the sour-rancid smell.

Since dry weather entry to the storm drainage system occurs intermittently, flow could be caused by either a direct or indirect connection. To locate the ultimate source of this discharge coming from the cheese factory, both direct and indirect industrial situations are considered under the category of “Food Processing” with SIC code of 2020 in Table A1 (see Appendix A). Thus, further examination of the loading dock procedures, water usage, and direct piping connections should be conducted since these categories all exhibit some potential for pollution in dairy production.

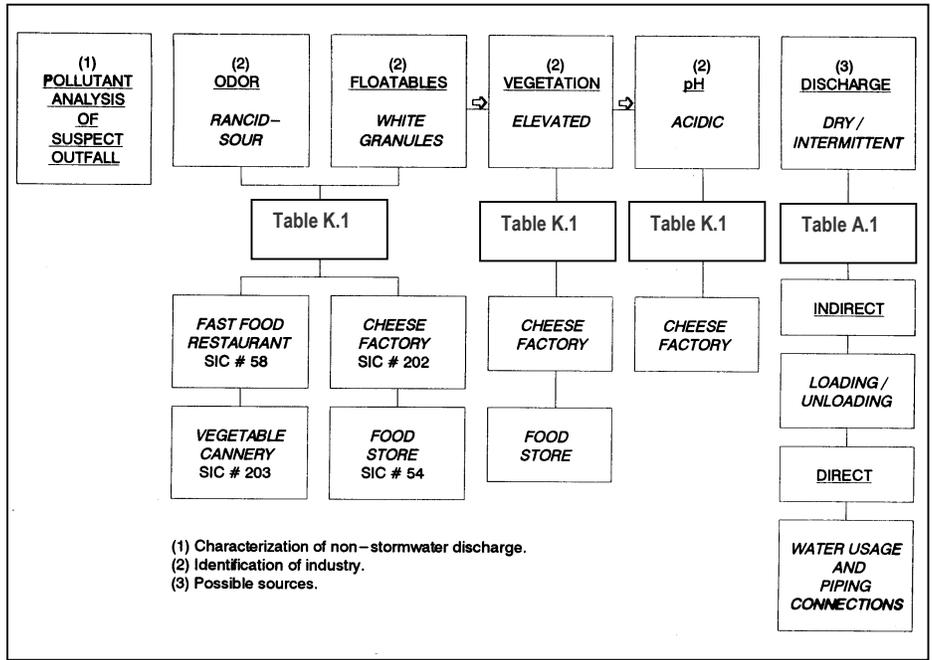


Figure K.3: Flowsheet for Case Example 2

Case Example 3

The results of the test measurements for the final situation found a normal pH (6) and low total dissolved solids (about 500 mg/L). Signs of contaminated discharges were found at the outfall only during and immediately following rainfalls. Other outfall properties observed included an odor of oil, deep brown to black color, a floating oil film, no structural damage, and inhibited plant growth (see Figure K.4).

According to Table K.1, the fast food restaurant and the used car dealer are the only two industrial sources in this hypothetical drainage area with a high potential for causing oily discharges. Their respective SIC categories are “Eating and Drinking Places” (SIC# 58) and

“Automotive Dealers” (SIC# 55). Comparison of the properties shown in Table K.1 indicates inhibited vegetation only for the second category. Thus, the most likely source of the discharge is the used car dealer.

Furthermore, the source of contamination must likely be indirect, since the discharge occurs only during wet weather. Reference to Table A.1 (see Appendix A) under the category of “Car Dealers,” indicates a medium potential for indirect contamination. This fact, plus the knowledge that most used cars are displayed outdoors, makes it clear that surface runoff is probably carrying spilled automotive oil into the storm drain during rains.

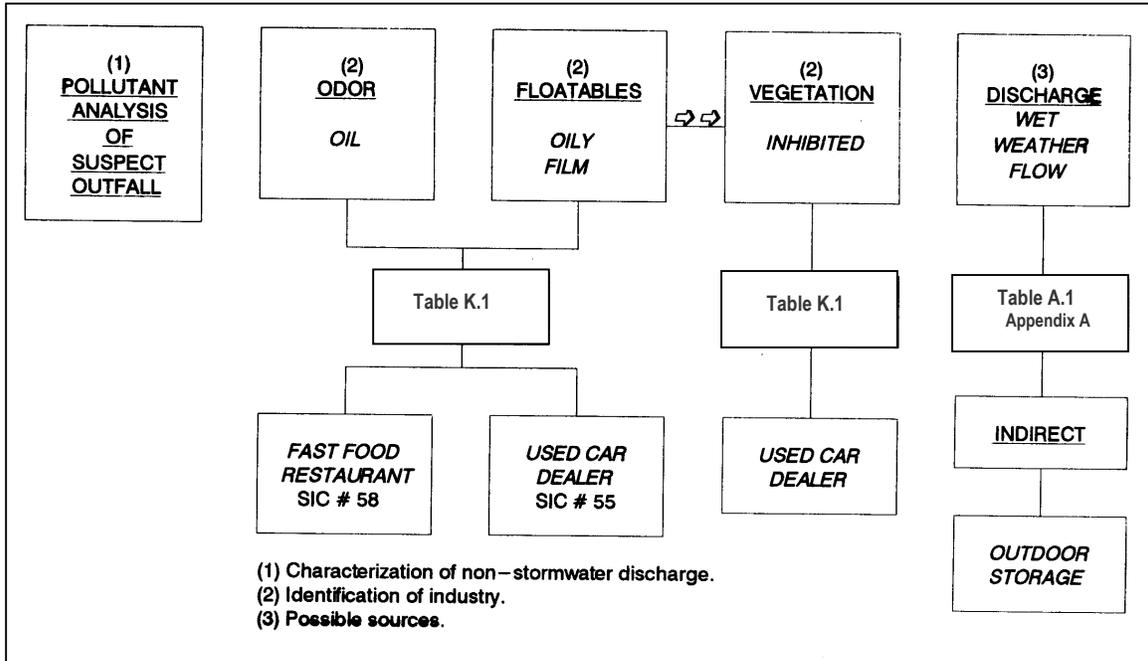


Figure K.4: Flowsheet for Case Example 3

References

Bannerman, R. 2003. Personal communication with Dr. Robert Pitt, University of Alabama.

Klein, L. 1962. "River Pollution 2: Causes and Effects." in D. Todd. 1979. *The Water Encyclopedia*. Water Information Center. Port Washington, N.Y.

Pitt, R. 2001. *Methods for Detection of Inappropriate Discharges to Storm Drainage Systems: Background Literature and Summary of Findings*. IDDE Project Support Material.

Exhibit 13

Illicit Discharge Detection and Elimination Mapping

The Town has developed several tools for tracking and formally documenting Illicit Discharge points throughout the municipality. Similar to Outfall Mapping, the Town has created and will maintain an IDDE Map and IDDE Tracking Spreadsheet, copies of which are included in this Exhibit. As the Town has not previously had a formal IDDE policy, the Map and Spreadsheet are not populated at this time. Currently, the Map has been used to indicate the Town's anticipated field inspection schedule. The Town will also look to shorten the proposed inspection schedule in order to establish a baseline IDDE reference for Town waterways.

Exhibit 14

Outfall Mapping

Based upon a joint GIS Mapping effort with Rensselaer County, there are approximately 220 municipal outfalls identified and mapped within the Town. Additionally, the Town has a database listing multiple outfall characteristics. A copy of the most recent GIS Outfall Map and Outfall Tracking Spreadsheet are attached to this Exhibit.

The Town believes that the outfall survey is somewhat outdated, however, and has developed and begun to implement a procedure to inspect, review, and map outfalls throughout the Town. The major components of the outfall mapping project are discussed below.

Outfall Mapping Project Objectives:

- Review and Inspect Existing Outfalls

The original outfall database was created around 2007. The Town will be undertaking the process of reviewing and inspecting all currently catalogued outfalls to verify and supplement the information listed within the Outfall Tracking Spreadsheet and will update the spreadsheet as necessary. Details regarding outfall inspections are discussed within Exhibit 15.

- Identify New Outfalls

The Town will be conducting a review of new construction projects as well as field investigations to identify potentially new or uncatalogued outfalls and adding them to the Outfall Tracking Spreadsheet.

- Update Outfall Mapping

The Town is working on implementing a GIS Mapping System for several stormwater, utility, and resource elements within its boundaries. The Town will update its outfall mapping based upon the inspection of existing outfalls and identification of new outfalls as discussed above.

Proposed Outfall Mapping Project Schedule:

The Town anticipates that the Outfall Mapping Project will take two years to fully implement. The Town plans to conduct catalogued inspections of outfalls as follows:

2021 Objectives

- The Town will inspect/verify a minimum of 103 of the outfalls listed on the Outfall Tracking Spreadsheet during 2021. These outfalls have been indicated by the designation “Pending 2021” in the “Town Inspection Column” of the tracking spreadsheet and were chosen based upon the following criteria:
 - Snyder’s Lake Area. Snyder’s Lake is identified as a Town Waterbody of Concern.

- Wynants Kill and Mill Creek Area. The Wynants Kill and Mill Creek are identified as Town Waterbodies of Concern.
- Outfalls West of Route 4. Minor tributaries to the Hudson River are identified as Town Waterbodies of Concern, and an effort will be made to inspect outfalls west of Route 4, and therefor closer to the Hudson River.
- Outfalls Exhibiting Prior Flow: The Town will inspect existing outfalls that were noted to have prior flow during the development of the tracking spreadsheet to determine if flow characteristics have changed substantially.

If practicable, the Town will inspect other outfalls in close proximity to those identified as requiring inspection during 2021.

- The Town will review new construction and determine if any outfalls need to be added to the Outfall Tracking Spreadsheet.
- The Town will conduct field observations to determine if any existing outfalls remain unmapped, and will add them to the Outfall Tracking Spreadsheet. The Town expects to accomplish this in conjunction with the IDDE Mapping scheduled for 2021.
- The Town will continue efforts to implement a GIS mapping system. This is currently being undertaken for several reasons, including stormwater, utilities and natural recourse mapping. If a GIS system is not fully realized during 2021, the Town will continue to update existing maps using other electronic software or red-line markups.

2022 Objectives

- The Town will inspect/verify the remainder of the outfalls listed on the Outfall Tracking Spreadsheet during 2022, and will also re-inspect any outfalls from 2021 that were deemed to warrant further investigation.
- The Town will continue to monitor new construction and determine if any outfalls need to be added to the Outfall Tracking Spreadsheet.
- The Town will continue to conduct field observations to determine if any existing outfalls remain unmapped, and will add them to the Outfall Tracking Spreadsheet. This work will again be undertaken in conjunction with the IDDE Program.
- The Town plans to finalize and implement a GIS mapping system. At that time, it is anticipated that mapping can be transferred to the GIS system for future identification and tracking.

At the end of 2022, the Town anticipates that the Outfall Mapping Project will be complete and that a more current outfall baseline measurement will be established. From that point forward, Outfall inspection and monitoring will proceed as per Exhibit 15.

Town of North Greenbush Outfall Tracking Spreadsheet

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG1	Seep	CPP	Circular	No	No	12	Good	N	None	South	None	Clear	None	Indirect	Lake/Pond	Lake/Pond	726230.67346	1394155.74229	Pending 2021	Summer 2020
NG2	Culvert	CPP	Circular	No	No	18	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Lake/Pond	725885.34917	1392615.12686	Pending 2021	Summer 2020
NG3	Culvert	CPP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Direct	Wetland	NBM-UN15	726596.43627	1390529.64872		Summer 2020
NG4	Culvert	CPP	Circular	Partially	No	30	Good	N	None	NW	None	Clear	None	Direct	Stream	Snyders Lake	726604.74245	1396088.73583	Pending 2021	Summer 2020
NG5	Culvert	CMP	Circular	No	No	24	Good	N	None	NE	None	Clear	None	Direct	Stream	W-UN8	727332.39506	1398379.41154		Summer 2020
NG6	Culvert	CPP	Circular	Partially	No	38	Good	Y	Moderate	NE	None	Clear	None	Direct	Stream	W-UN8	727714.54750	1398666.94229	Pending 2021	Summer 2020
NG7	Culvert	CPP	Circular	No	No	38	Good	Y	Moderate	NE	None	Clear	None	Direct	Stream	W-UN8	727890.22571	1398662.55701	Pending 2021	Summer 2020
NG8	Culvert	CPP	Circular	No	No	18	Good	N	None	NE	None	Clear	None	Direct	Stream	W-UN8	728133.26136	1398787.29583		Summer 2020
NG9	Seep	CPP	Circular	No	Partially	12	Good	N	None	NE	None	Clear	None	Indirect	Stream	Wynants Kill	727457.26238	1399831.24207	Pending 2021	Summer 2020
NG10	Seep	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Stream	W-UN7	726642.69112	1399856.27247		Summer 2020
NG11	Seep	CPP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Stream	W-UN8	726456.66744	1398554.32585		Summer 2020
NG12	Culvert	CPP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	726212.77854	1397590.89954	Pending 2021	Summer 2020
NG13	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Trickle	NE	None	Clear	None	Direct	Stream	W-UN8	726465.96510	1397683.57717		Summer 2020
NG14	Culvert	CMP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	725555.93989	1397338.08930	Pending 2021	Summer 2020
NG15	Culvert	CPP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	725049.40369	1397208.84693	Pending 2021	Summer 2020
NG16	Culvert	CP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724632.36664	1397213.08578	Pending 2021	Summer 2020
NG17	Culvert	CMP	Circular	No	Partially	8	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724408.41169	1397155.11484	Pending 2021	Summer 2020
NG18	Culvert	CPP	Circular	No	No	18	Good	Y	Trickle	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724274.66065	1397085.71989	Pending 2021	Summer 2020
NG19	Culvert	CMP	Circular	No	No	15	Fair	Y	Trickle	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724197.55064	1397026.76361	Pending 2021	Summer 2020
NG20	Culvert	Steel	Circular	No	No	14	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724175.46244	1396904.91836	Pending 2021	Summer 2020
NG21	Pipe	PVC	Circular	No	Partially	10	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724149.30360	1396685.77493	Pending 2021	Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG22	Culvert	CMP	Circular	No	No	10	Good	N	None	SE	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723954.50501	1396424.40252	Pending 2021	Summer 2020
NG23	Pipe	PVC	Circular	No	No	6	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723781.40830	1396375.76610	Pending 2021	Summer 2020
NG24	Pipe	PVC	Circular	No	No	10	Good	N	None	SE	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723708.45777	1396231.67445	Pending 2021	Summer 2020
NG25	Culvert	CPP	Circular	No	No	18	Good	N	None	SE	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723688.48952	1396216.25608	Pending 2021	Summer 2020
NG26	Seep	CPP	Circular	No	No	15	Good	N	None	NW	None	Clear	None	Indirect	Wetland	Snyders Lake	724979.67902	1392401.39298	Pending 2021	Summer 2020
NG27	Culvert	CPP	Circular	No	No	30	Good	N	None	NORTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	724232.71275	1394699.30402	Pending 2021	Summer 2020
NG28	Culvert	CMP	Circular	No	Partially	24	Good	N	None	NORTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723649.46846	1394814.13410	Pending 2021	Summer 2020
NG29	Culvert	CP	Circular	Fully	Fully	10	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723370.02961	1395040.03925	Pending 2021	Summer 2020
NG30	Culvert	CPP	Circular	No	No	12	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723304.43320	1395197.53020	Pending 2021	Summer 2020
NG31	Culvert	CPP	Circular	No	No	12	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723204.91038	1395604.42402	Pending 2021	Summer 2020
NG32	Culvert	CPP	Circular	No	No	12	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723256.64798	1395654.82325	Pending 2021	Summer 2020
NG33	Culvert	CB	Circular	No	No	72	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723272.85022	1395686.75516	Pending 2021	Summer 2020
NG34	Culvert	CPP	Circular	No	No	18	Good	N	None	EAST	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723273.45617	1395699.48834	Pending 2021	Summer 2020
NG35	Culvert	CPP	Circular	No	Partially	12	Good	Y	Trickle	SE	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723473.28184	1396032.21256	Pending 2021	Summer 2020
NG36	Culvert	CPP	Circular	No	No	24	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	Snyders Lake	723564.59473	1396153.90472	Pending 2021	Summer 2020
NG37	Seep	CPP	Circular	No	No	15	Good	N	None	NORTH	None	Clear	None	Indirect	Lake/Pond	W-UN7	723664.36843	1400334.20246	Pending 2021	Summer 2020
NG38	Culvert	CP	Circular	No	No	28	Good	Y	Trickle	EAST	None	Clear	None	Direct	Stream	W-UN7	723982.00094	1400690.75004	Pending 2021	Summer 2020
NG39	Seep	CPP	Circular	No	No	24	Good	Y	Trickle	SE	None	Clear	None	Indirect	Wetland	W-UN7	724806.20779	1402167.53622	Pending 2021	Summer 2020
NG40	Seep	CMP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Stream	W-UN5	725044.84280	1403977.68252		Summer 2020
NG41	Seep	CPP	Circular	No	No	12	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN7	727318.57694	1400893.92214		Summer 2020
NG42	Culvert	CMP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Direct	Wetland	W-UN7	727740.81208	1401612.12860		Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG43	Seep	CMP	Circular	No	No	12	Good	N	None	NE	None	Clear	None	Indirect	Wetland	Wetland	726060.33617	1403981.62467		Summer 2020
NG44	Seep	CMP	Circular	No	Partially	15	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN5	725198.06571	1403631.81116		Summer 2020
NG45	Seep	CPP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Wetland	W-UN7	725282.48581	1403277.46979		Summer 2020
NG46	Seep	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN5	725162.82117	1403871.74921		Summer 2020
NG47	Seep	CPP	Circular	No	No	30	Good	Y	Trickle	NORTH	None	Clear	None	Indirect	Wetland	W-UN5	725336.85176	1404300.17724	Pending 2021	Summer 2020
NG48	Culvert	CMP	Circular	No	No	24	Good	N	None	SE	None	Clear	None	Direct	Stream	W-UN5	724231.92248	1404824.04489		Summer 2020
NG49	Seep	CPP	Circular	No	No	15	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	Wynants Kill	726601.57598	1404591.91664	Pending 2021	Summer 2020
NG50	Seep	CPP	Circular	No	No	12	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	Wynants Kill	726423.58379	1404713.35664	Pending 2021	Summer 2020
NG51	Culvert	CPP	Circular	Fully	Fully	12	Good	N	None	EAST	None	Clear	None	Direct	Wetland	W-UN5	725231.86744	1405444.44937		Summer 2020
NG52	Culvert	CPP	Circular	No	No	12	Good	N	None	NORTH	None	Clear	None	Direct	Stream	Wynants Kill	724917.44645	1406873.50640	Pending 2021	Summer 2020
NG53	Culvert	CPP	Circular	No	No	12	Good	N	None	NORTH	None	Clear	None	Direct	Stream	Wynants Kill	725288.23557	1406559.23849	Pending 2021	Summer 2020
NG54	Culvert	CPP	Circular	No	No	15	Good	N	None	NORTH	None	Clear	None	Direct	Stream	Wynants Kill	725842.61509	1406135.57744	Pending 2021	Summer 2020
NG55	Culvert	CP	Circular	No	No	36	Good	Y	Trickle	NE	None	Clear	None	Direct	Stream	W-UN5	725720.07326	1405805.37763	Pending 2021	Summer 2020
NG56	Seep	CMP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Wetland	Moules Lake	731516.25119	1409954.20016		Summer 2020
NG58	Seep	CPP	Circular	No	No	15	Good	N	None	EAST	None	Clear	None	Indirect	Lake/Pond	W-UN6	730826.19960	1410127.27792		Summer 2020
NG59	Seep	CMP	Circular	No	Fully	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Wetland	Moules Lake	730937.66072	1410344.53411		Summer 2020
NG60	Seep	CPP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN4	729281.19762	1410704.46602		Summer 2020
NG61	Seep	CPP	Circular	No	No	15	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN4	729100.40120	1410285.02794		Summer 2020
NG62	Seep	PVC	Circular	No	No	4	Good	N	None	WEST	None	Clear	None	Indirect	Wetland	W-UN4	728713.83736	1409426.59158		Summer 2020
NG63	Culvert	CPP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Direct	Lake/Pond	W-UN4	728691.51928	1409372.37411		Summer 2020
NG64	Seep	CPP	Circular	No	No	18	Good	Y	Trickle	NW	None	Clear	None	Indirect	Wetland	W-UN4	728313.71448	1409573.91318	Pending 2021	Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG65	Seep	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN4	727734.24363	1409107.50141		Summer 2020
NG66	Seep	CPP	Circular	No	Partially	15	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN4	727260.71147	1408911.94787		Summer 2020
NG67	Culvert	CP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Stream	W-UN4	726417.11109	1407524.67593		Summer 2020
NG68	Seep	CMP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Indirect	Stream	W-UN4	726448.72581	1407229.02614		Summer 2020
NG69	Culvert	CPP	Circular	No	No	15	Good	N	None	SE	None	Clear	None	Direct	Lake/Pond	W-UN4	725395.71486	1409886.88087		Summer 2020
NG70	Culvert	CMP	Circular	No	No	18	Good	N	None	SW	None	Clear	None	Direct	Stream	Wynants Kill	723961.01867	1408176.06691	Pending 2021	Summer 2020
NG71	Seep	CPP	Circular	No	No	12	Good	N	None	SW	None	Clear	None	Indirect	Stream	Wynants Kill	725037.86270	1408491.12458	Pending 2021	Summer 2020
NG72	Pipe	Steel	Circular	No	No	4	Good	N	None	SW	None	Clear	None	Indirect	Stream	Wynants Kill	724568.77547	1408895.43562	Pending 2021	Summer 2020
NG73	Seep	CPP	Circular	No	No	15	Good	N	None	SW	None	Clear	None	Indirect	Stream	Wynants Kill	723767.77349	1408601.19869	Pending 2021	Summer 2020
NG74	Culvert	CMP	Circular	No	No	18	Poor	N	None	SW	None	Clear	None	Indirect	Stream	Wynants Kill	723138.13150	1409472.64598	Pending 2021	Summer 2020
NG75	Overland Flow	CMP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Indirect	Stream	Wynants Kill	722489.67326	1409084.90147	Pending 2021	Summer 2020
NG76	Overland Flow	CPP	Circular	No	No	15	Good	N	None	SOUTH	None	Clear	None	Indirect	Stream	Wynants Kill	722281.63640	1409500.61936	Pending 2021	Summer 2020
NG79	Culvert	CMP	Circular	No	No	18	Good	Y	Trickle	WEST	None	Clear	None	Direct	Stream	Wynants Kill	723259.46513	1407859.96200	Pending 2021	Summer 2020
NG80	Culvert	CMP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Direct	Stream	Wynants Kill	722942.43469	1408142.84541	Pending 2021	Summer 2020
NG81	Culvert	CMP	Circular	Fully	No	12	Good	N	None	WEST	None	Clear	None	Direct	Stream	Wynants Kill	721931.80775	1408146.90592	Pending 2021	Summer 2020
NG82	Overland Flow	CMP	Circular	No	No	12	Good	N	None	NE	None	Clear	None	Indirect	Stream	Wynants Kill	723052.21892	1407215.82729	Pending 2021	Summer 2020
NG85	Culvert	Steel	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Direct	Stream	W-UN3	721669.93540	1407262.35350		Summer 2020
NG86	Transport Culvert	CMP	Elliptical	No	No	90	Good	N	None	NW	None	Clear	None	Direct	Stream	W-UN3	721654.55637	1407238.85994		Summer 2020
NG87	Culvert	CP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Stream	Wynants Kill	721947.92657	1408193.52662	Pending 2021	Summer 2020
NG88	Transport Culvert	CMP	Circular	No	No	72	Good	N	None	WEST	None	Clear	None	Direct	Stream	W-UN3	721065.48647	1407442.87788		Summer 2020
NG89	Overland Flow	CMP	Circular	No	Partially	12	Good	N	None	NW	None	Clear	None	Indirect	Stream	W-UN3	721057.22987	1407217.17846		Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG90	Seep	CMP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Indirect	Stream	W-UN3	722336.98846	1406315.15990		Summer 2020
NG91	Seep	CPP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Indirect	Upland	W-UN3	722757.37835	1405691.01040		Summer 2020
NG92	Seep	PVC	Circular	No	No	8	Good	N	None	NW	None	Clear	None	Indirect	Upland	W-UN3	722723.59224	1405700.63293		Summer 2020
NG93	Culvert	CMP	Circular	No	No	12	Good	N	None	NORTH	None	Clear	None	Direct	Stream	W-UN3	721671.99031	1406649.91267		Summer 2020
NG94	Culvert	CMP	Circular	No	No	12	Good	N	None	NORTH	Other	Clear	None	Indirect	Stream	W-UN3	721843.89355	1406435.78813		Summer 2020
NG95	Transport Culvert	CP	Circular	No	No	40	Good	N	None	NORTH	None	Clear	None	Direct	Stream	W-UN3	721099.03082	1405822.62078		Summer 2020
NG96	Culvert	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN2	720769.41137	1406829.21046		Summer 2020
NG97	Transport Culvert	CPP	Circular	No	No	36	Good	N	None	NE	None	Clear	None	Direct	Stream	W-UN3	719733.85374	1403016.98543		Summer 2020
NG98	Culvert	CPP	Circular	No	No	12	Good	N	None	NE	None	Clear	None	Direct	Wetland	W-UN3	719739.65495	1402555.15631		Summer 2020
NG99	Culvert	CPP	Circular	No	Partially	18	Good	N	None	WEST	None	Clear	None	Direct	Wetland	W-UN3	719977.74494	1401746.94819		Summer 2020
NG100	Culvert	CPP	Circular	No	Fully	15	Good	N	None	WEST	None	Clear	None	Direct	Wetland	W-UN3	720613.62436	1401330.76950		Summer 2020
NG101	Culvert	CPP	Circular	No	No	15	Good	N	None	WEST	None	Clear	None	Direct	Stream	W-UN3	720996.67588	1401247.69980		Summer 2020
NG102	Culvert	CPP	Circular	No	No	15	Good	N	None	WEST	None	Clear	None	Direct	Stream	W-UN3	721384.15339	1401198.57135		Summer 2020
NG103	Culvert	CPP	Circular	Partially	No	15	Good	N	None	NW	None	Clear	None	Direct	Wetland	W-UN3	722688.52561	1399758.89878		Summer 2020
NG104	Transport Culvert	CPP	Circular	No	No	48	Good	N	None	EAST	None	Clear	None	Direct	Stream	W-UN2	720342.69188	1407528.14294		Summer 2020
NG105	Culvert	CPP	Circular	No	Partially	18	Good	N	None	SE	None	Clear	None	Direct	Wetland	Wynants Kill	719491.56459	1408746.50378	Pending 2021	Summer 2020
NG106	Seep	CMP	Circular	No	Partially	12	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN1	715563.74122	1407790.49251		Summer 2020
NG107	Seep	CPP	Circular	No	No	15	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN1	715424.89936	1407945.58166		Summer 2020
NG108	Seep	CPP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Indirect	Wetland	W-UN1	715423.20029	1407943.86109		Summer 2020
NG109	Transport Culvert	CB	Box	No	No	48	Good	N	None	NE	None	Clear	None	Direct	Stream	W-UN2	717007.10737	1406501.36816		Summer 2020
NG110	Culvert	CMP	Circular	No	No	15	Good	N	None	NW	None	Clear	None	Direct	Wetland	W-UN1	714619.90685	1408180.78218		Summer 2020

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NG111	Culvert	CPP	Circular	No	Fully	8	Poor	N	None	NW	None	Clear	None	Direct	Wetland	W-UN1	713856.79927	1407646.88726		Summer 2020
NG112	Culvert	CMP	Circular	Fully	No	18	Good	Y	Trickle	NW	None	Orange	Opaque	Direct	Wetland	W-UN1	713354.20010	1407484.53616	Pending 2021	Summer 2020
NG113	Seep	CMP	Circular	No	Fully	12	Poor	N	None	WEST	None	Clear	None	Indirect	Upland	W-UN1	714740.94954	1407039.72694		Summer 2020
NG114	Seep	CPP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	W-UN1	714385.18916	1406989.93187		Summer 2020
NG115	Seep	CPP	Circular	No	Partially	12	Good	N	None	NORTH	None	Clear	None	Indirect	Upland	W-UN1	713891.93168	1406961.66461		Summer 2020
NG116	Culvert	CPP	Circular	No	No	15	Good	N	None	NE	None	Clear	None	Direct	Lake/Pond	W-UN2	715672.84893	1405121.83203		Summer 2020
NG117	Culvert	CPP	Circular	No	No	15	Good	N	None	NE	None	Clear	None	Direct	Lake/Pond	W-UN2	715037.95818	1405616.35619		Summer 2020
NG118	Seep	CPP	Circular	No	No	8	Good	N	None	NORTH	None	Clear	None	Indirect	Wetland	W-UN1	713818.93124	1404080.79139		Summer 2020
NG119	Culvert	CPP	Circular	No	No	24	Good	N	None	NORTH	None	Clear	None	Direct	Wetland	W-UN2	717171.05335	1402686.37219		Summer 2020
NG120	Culvert	Steel	Circular	No	No	30	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN22	713829.88266	1402929.59395		Summer 2020
NG121	Culvert	CPP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN22	712591.53975	1402978.48943		Summer 2020
NG122	Seep	CMP	Circular	No	Partially	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN22	712225.83479	1401297.57065		Summer 2020
NG123	Seep	CMP	Circular	No	Partially	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN23	712317.47075	1401313.63926		Summer 2020
NG124	Seep	CPP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN22	714170.81245	1404310.30307		Summer 2020
NG125	Seep	CPP	Circular	No	No	24	Good	Y	Moderate	SOUTH	None	Clear	None	Indirect	Wetland	HUD-UN22	711057.97738	1406557.55709	Pending 2021	Summer 2020
NG126	Seep	CPP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN22	712375.13040	1404297.60649		Summer 2020
NG127	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Substantial	WEST	None	Clear	None	Direct	Stream	HUD-UN22	712203.71741	1403106.05039	Pending 2021	Summer 2020
NG128	Culvert	CMP	Circular	No	No	12	Good	Y	Moderate	NORTH	None	Clear	None	Direct	Stream	HUD-UN22	711393.04323	1403218.73340	Pending 2021	Summer 2020
NG129	Culvert	CP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN24	711087.98903	1400490.81814		Summer 2020
NG131	Culvert	CPP	Circular	No	No	15	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN21	709951.79523	1406756.80470	Pending 2021	Summer 2020
NG132	Culvert	CPP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN21	707480.64285	1406480.84438	Pending 2021	Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG133	Culvert	CPP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN21	707297.40393	1406416.01187	Pending 2021	Summer 2020
NG134	Seep	Steel	Circular	No	No	30	Good	Y	Substantial	WEST	None	Clear	None	Indirect	Stream	HUD-UN22	709971.50006	1406349.87837	Pending 2021	Summer 2020
NG135	Seep	PVC	Circular	Partially	No	10	Good	N	None	WEST	None	Clear	None	Indirect	Stream	HUD-UN22	709732.48618	1405872.54384	Pending 2021	Summer 2020
NG136	Seep	CPP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Indirect	Stream	HUD-UN22	709493.23574	1405386.58211	Pending 2021	Summer 2020
NG137	Transport Culvert	CMP	Circular	No	No	54	Good	Y	Substantial	NW	None	Clear	None	Direct	Stream	HUD-UN22	708996.96643	1404953.73193	Pending 2021	Summer 2020
NG138	Seep	CMP	Circular	No	Partially	12	Good	N	None	NORTH	None	Clear	None	Indirect	Upland	HUD-UN22	709633.59901	1403778.92771	Pending 2021	Summer 2020
NG139	Seep	CPP	Circular	No	No	15	Good	N	None	NORTH	None	Clear	None	Indirect	Upland	HUD-UN22	709509.83965	1403346.44617	Pending 2021	Summer 2020
NG140	Seep	Steel	Circular	Fully	No	12	Good	N	None	SOUTH	None	Gray	Slightly Cloudy	Indirect	Upland	HUD-UN23	709729.37373	1402822.56700	Pending 2021	Summer 2020
NG141	Culvert	CPP	Circular	No	No	24	Good	N	None	NORTH	None	Clear	None	Direct	Stream	HUD-UN23	707582.42409	1403747.28252	Pending 2021	Summer 2020
NG142	Culvert	CMP	Circular	No	No	60	Good	Y	Moderate	WEST	None	Clear	None	Direct	Stream	HUD-UN23	706166.37929	1403722.56086	Pending 2021	Summer 2020
NG143	Culvert	CPP	Circular	No	No	36	Good	Y	Trickle	WEST	None	Clear	None	Direct	Stream	HUD-UN23	706127.74736	1403703.07004	Pending 2021	Summer 2020
NG144	Culvert	CMP	Circular	No	No	30	Good	Y	Trickle	NW	None	Clear	None	Indirect	Stream	HUD-UN23	707182.47760	1402532.79446	Pending 2021	Summer 2020
NG145	Seep	CMP	Circular	No	No	36	Good	Y	Moderate	NW	None	Clear	None	Indirect	Wetland	HUD-UN23	707153.91901	1403093.72476	Pending 2021	Summer 2020
NG146	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Moderate	WEST	None	Clear	None	Direct	Stream	HUD-UN24	708922.29942	1401226.23804	Pending 2021	Summer 2020
NG147	Culvert	CMP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN24	708870.92560	1401211.04649	Pending 2021	Summer 2020
NG148	Culvert	CMP	Circular	No	Partially	12	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN24	709436.46954	1400780.32982	Pending 2021	Summer 2020
NG149	Culvert	CPP	Circular	No	No	36	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN24-3	708802.85853	1395804.15957	Pending 2021	Summer 2020
NG150	Culvert	CMP	Circular	No	No	24	Good	Y	Moderate	WEST	None	Clear	None	MS4	Stream	HUD-UN24-2	706589.78512	1395742.28309	Pending 2021	Summer 2020
NG151	Culvert	CPP	Circular	No	Partially	12	Good	N	None	WEST	None	Clear	None	MS4	Stream	HUD-UN24-2	706618.69776	1395533.52328	Pending 2021	Summer 2020
NG152	Culvert	CPP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	MS4	Stream	HUD-UN24-1	707152.46697	1394736.61525	Pending 2021	Summer 2020
NG153	Culvert	CPP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	MS4	Stream	HUD-UN24-1	707153.52041	1394727.88411		Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG154	Culvert	CPP	Circular	Partially	No	12	Good	N	None	WEST	None	Clear	None	MS4	Stream	HUD-UN24-1	707207.82723	1394162.72367	Pending 2021	Summer 2020
NG155	Culvert	CPP	Circular	Fully	No	12	Good	N	None	WEST	None	Clear	None	MS4	Stream	HUD-UN24-1	707208.36406	1394036.61883	Pending 2021	Summer 2020
NG156	Culvert	CP	Elliptical	No	No	27	Good	N	None	NW	None	Clear	None	MS4	Stream	HUD-UN24-1	707322.30070	1393466.59848	Pending 2021	Summer 2020
NG157	Seep	CMP	Circular	No	Fully	12	Good	N	None	WEST	None	Clear	None	MS4	Upland	HUD-UN25	704094.65961	1393230.58082	Pending 2021	Summer 2020
NG158	Seep	PVC	Circular	No	No	12	Good	N	None	SW	None	Clear	None	MS4	Upland	HUD-UN25	705203.87049	1392819.53775	Pending 2021	Summer 2020
NG159	Seep	CMP	Circular	No	Partially	8	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN25	706199.23920	1392695.21442	Pending 2021	Summer 2020
NG160	Overland Flow	CPP	Circular	No	No	36	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN25	706135.06691	1392434.80174	Pending 2021	Summer 2020
NG161	Seep	CP	Circular	No	Fully	36	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN25	705486.42691	1392257.75394	Pending 2021	Summer 2020
NG162	Culvert	CP	Circular	No	No	24	Good	N	None	SOUTH	None	Clear	None	Indirect	Wetland	HUD-UN24-1	707155.03696	1393012.24200	Pending 2021	Summer 2020
NG163	Culvert	PVC	Circular	No	Partially	6	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN25	708968.49693	1390821.96795		Summer 2020
NG164	Seep	CPP	Circular	No	No	30	Good	Y	Moderate	SW	None	Clear	None	Indirect	Upland	HUD-UN25	708189.60617	1392139.30530	Pending 2021	Summer 2020
NG165	Seep	CMP	Circular	No	No	12	Poor	N	None	WEST	None	Clear	None	MS4	Upland	HUD-UN24-1	708675.35133	1394869.76239	Pending 2021	Summer 2020
NG166	Seep	CMP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Indirect	Upland	HUD-UN24-3	710105.56982	1397133.97487		Summer 2020
NG167	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Moderate	WEST	None	Clear	None	Direct	Stream	HUD-UN25	709706.63146	1390568.49595	Pending 2021	Summer 2020
NG168	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Trickle	WEST	None	Clear	None	Direct	Stream	HUD-UN25	709236.89526	1390858.31125	Pending 2021	Summer 2020
NG169	Transport Culvert	CB	Box	No	No	36	Good	N	None	SW	None	Clear	None	Direct	Stream	HUD-UN25	710588.33590	1390842.93179		Summer 2020
NG170	Transport Culvert	CMP	Circular	No	No	36	Good	Y	Trickle	WEST	None	Clear	None	Direct	Stream	HUD-UN25	710122.55440	1390353.92878	Pending 2021	Summer 2020
NG171	Culvert	CP	Circular	No	No	24	Good	N	None	SW	None	Clear	None	Direct	Wetland	HUD-UN25	711261.58263	1390090.97608		Summer 2020
NG172	Culvert	CMP	Circular	No	No	36	Good	Y	Trickle	WEST	None	Clear	None	Direct	Wetland	HUD-UN25	711897.86346	1391190.85269	Pending 2021	Summer 2020
NG173	Culvert	CMP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Direct	Wetland	HUD-UN25	711869.35530	1391221.64437		Summer 2020
NG174	Culvert	CMP	Circular	No	No	12	Poor	Y	Trickle	WEST	None	Clear	None	Direct	Wetland	HUD-UN25	711287.30960	1391136.38946	Pending 2021	Summer 2020

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG175	Culvert	CMP	Circular	No	Partially	12	Good	N	None	SW	None	Clear	None	Direct	Wetland	HUD-UN25	710821.01047	1391128.06408		Summer 2020
NG176	Overland Flow	CPP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN25	710747.20669	1391803.11355		Summer 2020
NG177	Seep	CPP	Circular	Partially	Partially	24	Good	Y	Trickle	SW	None	Clear	None	Indirect	Upland	HUD-UN25	710065.07472	1391448.12014	Pending 2021	Summer 2020
NG178	Culvert	CMP	Circular	No	No	15	Good	Y	Trickle	WEST	None	Clear	None	Direct	Wetland	HUD-UN25	712383.86128	1391048.14677	Pending 2021	Summer 2020
NG179	Seep	CPP	Circular	No	No	12	Good	N	None	EAST	None	Clear	None	Indirect	Wetland	HUD-UN24-3	712699.74685	1390287.36955		Summer 2020
NG180	Seep	CPP	Circular	No	No	15	Fair	N	None	EAST	None	Clear	None	Indirect	Wetland	HUD-UN24-3	712865.41495	1390634.55982		Summer 2020
NG181	Culvert	CPP	Circular	No	Partially	12	Good	N	None	WEST	None	Clear	None	Direct	Wetland	HUD-UN24-3	712989.76848	1390710.34530		Summer 2020
NG182	Seep	CMP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN25	712122.10103	1393369.60751		Summer 2020
NG183	Seep	CPP	Circular	No	No	12	Good	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN25	711843.58915	1393419.44559		Summer 2020
NG184	Seep	CMP	Circular	Partially	Partially	12	Poor	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN25	711525.69322	1393376.68719		Summer 2020
NG185	Seep	Steel	Circular	No	No	12	Poor	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN25	711543.11811	1393553.91317		Summer 2020
NG186	Seep	CPP	Circular	No	No	12	Good	N	None	SW	None	Clear	None	Indirect	Upland	HUD-UN25	710702.52496	1393036.51541		Summer 2020
NG187	Seep	CPP	Circular	No	No	12	Good	N	None	SW	None	Clear	None	Indirect	Upland	HUD-UN25	710775.65034	1393491.83394		Summer 2020
NG188	Culvert	CPP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN24-3	710339.51696	1395917.19330		Summer 2020
NG189	Transport Culvert	CB	Box	Partially	No	54	Good	Y	Moderate	NW	None	Clear	None	Direct	Stream	HUD-UN24-3	710304.61162	1395923.86748	Pending 2021	Summer 2020
NG190	Transport Culvert	CB	Box	No	No	36	Good	Y	Substantial	NW	None	Clear	None	Direct	Stream	HUD-UN24	711271.90710	1400242.85474	Pending 2021	Summer 2020
NG191	Culvert	CPP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN24	711242.09411	1400177.86223		Summer 2020
NG192	Seep	CP	Circular	No	No	18	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24-5	710576.91216	1398505.70479		Summer 2020
NG193	Seep	CPP	Circular	No	No	15	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24-4	710456.12880	1397202.96738		Summer 2020
NG194	Seep	CMP	Circular	No	No	12	Poor	N	None	WEST	None	Clear	None	MS4	Upland	HUD-UN24-1	710707.96906	1394624.93346		Summer 2020
NG195	Seep	CPP	Circular	No	Partially	15	Good	N	None	WEST	None	Clear	None	MS4	Upland	HUD-UN24-1	710479.68950	1394232.69051		Summer 2020

Town of North Greenbush Outfall Tracking Spreadsheet

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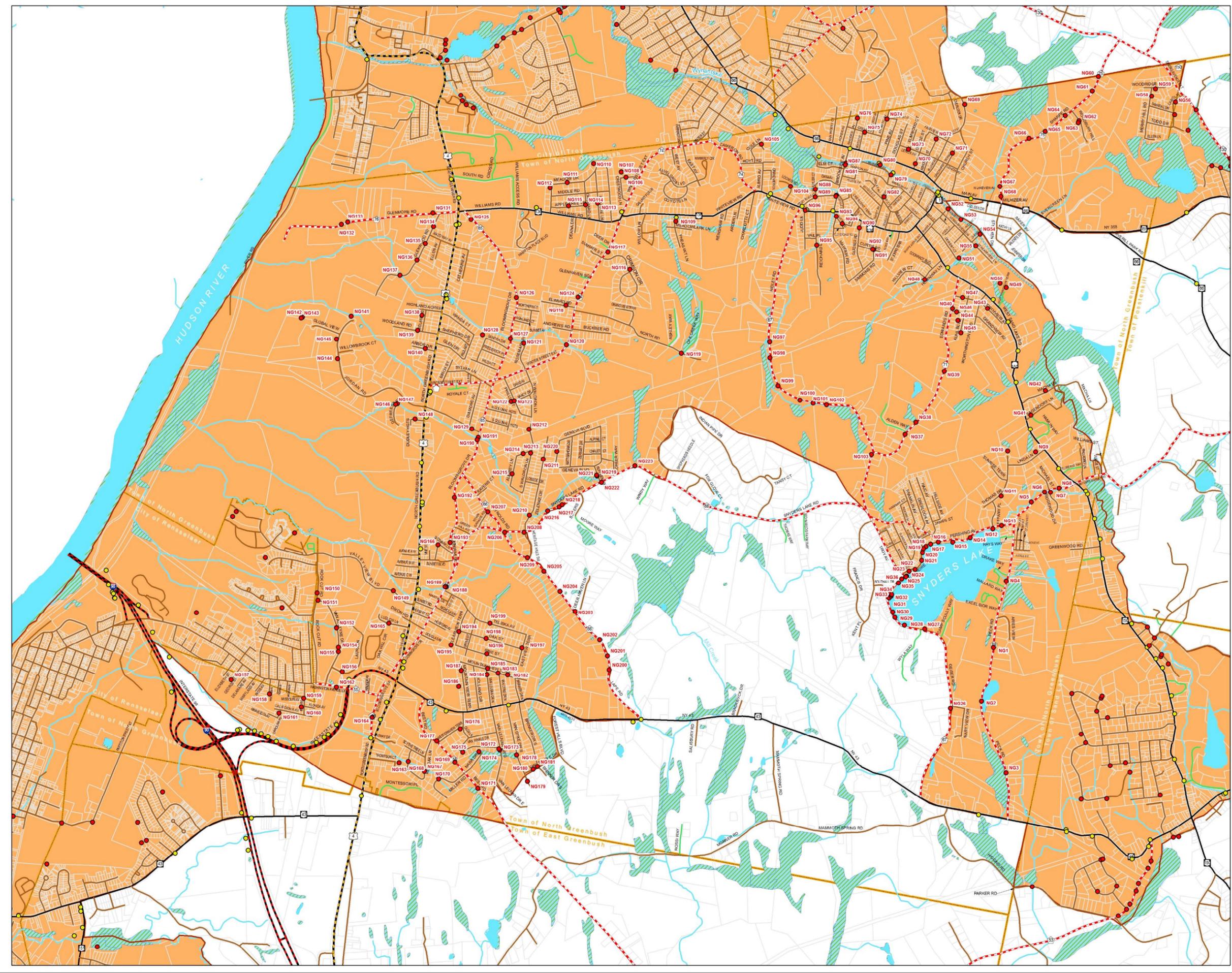
Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG196	Seep	CMP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Indirect	Upland	HUD-UN25	711516.06070	1393975.96629		Summer 2020
NG197	Seep	CMP	Circular	No	No	15	Good	N	None	SW	None	Clear	None	Indirect	Upland	HUD-UN25	712539.62448	1394146.25621		Summer 2020
NG198	Seep	CPP	Circular	No	No	15	Good	Y	Trickle	NORTH	None	Clear	None	Indirect	Wetland	HUD-UN24-3	711498.10384	1394426.63279	Pending 2021	Summer 2020
NG199	Seep	CMP	Circular	Partially	No	15	Poor	N	None	NORTH	None	Clear	None	Indirect	Wetland	HUD-UN24-3	711613.33021	1394865.66357		Summer 2020
NG200	Culvert	CPP	Circular	No	No	15	Good	N	None	EAST	None	Clear	None	Direct	Wetland	MC-UN17	715071.77834	1393513.44264		Summer 2020
NG201	Culvert	CPP	Circular	No	Partially	15	Good	N	None	EAST	None	Clear	None	Direct	Wetland	MC-UN17	715022.27229	1393915.56949		Summer 2020
NG202	Culvert	CB	Elliptical	No	No	24	Good	N	None	EAST	None	Clear	None	Direct	Wetland	Mill Creek	714793.84887	1394391.14402	Pending 2021	Summer 2020
NG203	Culvert	CPP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Wetland	HUD-UN24-3	714083.03184	1395211.03036		Summer 2020
NG204	Culvert	CPP	Circular	No	No	15	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN24-3	713645.07703	1395790.70242		Summer 2020
NG205	Culvert	CPP	Circular	No	No	15	Good	N	None	SW	None	Clear	None	Direct	Stream	HUD-UN24-3	713176.49181	1396372.36924		Summer 2020
NG206	Seep	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Indirect	Stream	HUD-UN24	712035.71843	1397491.17577		Summer 2020
NG207	Seep	CMP	Circular	No	No	24	Good	N	None	NORTH	None	Clear	None	Indirect	Stream	HUD-UN24	711550.32016	1398096.13372		Summer 2020
NG208	Seep	CPP	Circular	No	Partially	18	Good	N	None	WEST	None	Clear	None	Indirect	Stream	HUD-UN24	712597.66839	1397491.94658		Summer 2020
NG209	Culvert	CPP	Circular	No	Partially	15	Good	N	None	WEST	None	Clear	None	Direct	Stream	HUD-UN24-3	712697.30205	1396758.01992		Summer 2020
NG210	Transport Culvert	Steel	Circular	No	Partially	44	Poor	Y	Moderate	NW	None	Clear	None	Direct	Stream	HUD-UN24	712756.38096	1397994.35017	Pending 2021	Summer 2020
NG211	Seep	CMP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24	713157.84247	1399622.62946		Summer 2020
NG212	Seep	CMP	Circular	No	Fully	12	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24	712745.13079	1400477.60214		Summer 2020
NG213	Seep	CMP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24	712792.61187	1399801.03049		Summer 2020
NG214	Seep	CMP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24	712573.93053	1399782.19734		Summer 2020
NG215	Seep	CMP	Circular	No	No	12	Fair	N	None	WEST	None	Clear	None	Indirect	Upland	HUD-UN24	712252.39120	1399195.58332		Summer 2020
NG216	Culvert	CMP	Circular	No	No	18	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN24	713288.52279	1398119.18677		Summer 2020

Town of North Greenbush Outfall Tracking Spreadsheet

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Outfall ID#	Type	Material	Shape	Submerged	Sediment	Dia	Cond	Flow	Flow Type	Flow Dir.	Odor	Color	Turbid	Entry	Outfall To	Name	X_COORD	Y_COORD	Town Inspection	Date
NG217	Culvert	CPP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Direct	Stream	HUD-UN24	713617.23088	1398233.89807		Summer 2020
NG218	Culvert	CMP	Circular	No	No	12	Good	N	None	NW	None	Clear	None	Direct	Wetland	HUD-UN24	713707.06384	1398298.09621		Summer 2020
NG219	Culvert	CPP	Circular	No	No	24	Good	N	None	WEST	None	Clear	None	Direct	Lake/Pond	HUD-UN24	714721.32944	1399129.30133		Summer 2020
NG220	Seep	CMP	Circular	No	No	15	Good	N	None	SW	None	Clear	None	Indirect	Upland	HUD-UN24	713551.48317	1399843.21622		Summer 2020
NG221	Culvert	CMP	Circular	No	No	12	Good	N	None	WEST	None	Clear	None	Direct	Lake/Pond	HUD-UN24	714708.80618	1399156.77833		Summer 2020
NG222	Seep	CPP	Circular	No	No	18	Good	N	None	SOUTH	None	Clear	None	Indirect	Upland	Lake/Pond	714848.53610	1398951.31913		Summer 2020
NG223	Culvert	CPP	Circular	No	No	18	Good	N	None	NORTH	None	Clear	None	Direct	Wetland	W-UN2	715821.22346	1399421.45442		Summer 2020

MS4 Outfalls Town of North Greenbush



Legend

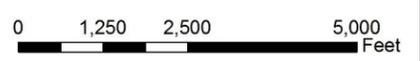
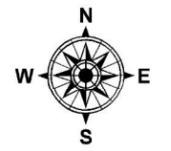
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- ▭ Municipal Boundary
- Waterbodies
- ▨ Wetlands

Roads

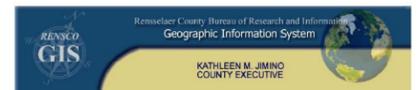
- County
- Interstate
- State
- US Highway
- Local
- Way

Route Markers

- Interstate
- State
- US Highway
- County



Kathleen M. Jimino
County Executive

Map printed November 2007

Exhibit 15

Outfall Inspection and Monitoring Procedures

Based upon a joint GIS Mapping effort with Rensselaer County, there are approximately 220 municipal outfalls identified and mapped within the Town. The current inventory of outfalls is presented in Exhibit 14. As also indicated in Exhibit 14, the Town believes that the outfall survey is somewhat outdated, and has developed and begun to implementing a procedure to inspect, review, and map outfalls throughout the Town to create an updated baseline outfall mapping tracking and location system.

The Town frequently conducts visual inspections of many of the outfalls on an annual basis as part of the Highway or Utilities Department routine maintenance and upkeep procedures, but has not previously implemented a system for formally logging inspections and inspection results. This Exhibit discusses the manner in which outfall inspections are to be conducted, and catalogued, both as a part of the Outfall Mapping Project, but also to regularly review and monitor municipal outfalls throughout the Town.

Dry Weather Monitoring Inspections:

- The Town strives to monitor all outfalls each year, but at a minimum, 25% of MS4 outfalls will receive a Dry Weather Monitoring Inspection annually. As part of the Outfall Mapping Project discussed in Exhibit 14, the Town anticipates inspecting all outfalls within the following one to two years to restore the outfall mapping baseline.
- All primary outfalls in identified priority areas will be inspected annually. As part of the Outfall Mapping Project, the Town will refine the definition of primary outfalls and priority areas. The preliminary definition of these terms is as follows:
 - Primary Outfalls are larger-diameter outfalls that have the potential to discharge larger flows or outfalls that are routinely observed to be active.
 - Priority Areas are locations where the outfall discharges directly, or nearly directly, into a Waterbody of Concern as identified in Exhibit 5, or areas in which the outfall is in close proximity to a potential generator of Pollutants of Concern as discussed in Exhibit 2.
- Inspections will be carried out by the Highway Department, Building Department, Utilities Department, Town Designated Engineer, or other qualified individual with the approval of the Stormwater Management Officer.
- Dry-Weather Inspections will be conducted following a minimum of 48 hours of dry weather (1/10th of an inch of precipitation or less).
- An outfall inspection form will be completed for each MS4 outfall inspected and a record maintained in the office of the Stormwater Management Officer. A copy of the Outfall Inspection Form is attached to this Exhibit.
- The Stormwater Management Officer will update the Outfall Tracking Spreadsheet and Outfall Map to reflect inspected outfalls and their location, and will work with the Highway

Department, Building Department, or other personnel as required to address outfall maintenance issues.

- Any illicit or suspected illicit discharges noted during inspections will be communicated to the Stormwater Management Officer the day of the inspection.
- In the event that any sampling occurs during an outfall inspection, this will be communicated to the Stormwater Management Officer the day of the inspection.
- Maintenance performed on outfall structures will be communicated to the Stormwater Management Officer prior to the commencement of work.

Storm Event Monitoring:

- The Town does not currently have a formal program for monitoring outfalls during storm events, and is discussing the development of a limited procedure to review outfall operation during a storm. Generally, the program would involve:
 - Witnessing outfall flows for primary outfalls in priority areas as defined above.
 - Witnessing flows for outfalls in which the public has contacted the Stormwater Management Officer with concerns.
 - Reviewing newly-installed outfalls to verify that they are operating generally as designed.

Town of North Greenbush Outfall Inspection Form

General Outfall Data

Outfall ID:	Location:	New?
Inspector:	Date:	Time:
Temp:	Rainfall inches in: Last 24 Hours	Last 48 Hours
Latitude:	Longitude:	As Mapped?
Photos:	Logged:	
Drainage Area Land Use (Select all that apply) <input type="checkbox"/> Industrial <input type="checkbox"/> Open Space <input type="checkbox"/> Urban Residential <input type="checkbox"/> Suburban Residential <input type="checkbox"/> Institutional <input type="checkbox"/> Commercial <input type="checkbox"/> Other: _____ Notes: _____ _____		Maintenance Priority <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low Notes: _____ _____ _____

Outfall Characteristics

<input type="checkbox"/> Closed Pipe Material <input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____ Shape and Configuration <input type="checkbox"/> Circular <input type="checkbox"/> Elliptical <input type="checkbox"/> Box <input type="checkbox"/> Other: _____ Diameter/Dimensions: _____ <input type="checkbox"/> Single <input type="checkbox"/> Double <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____ Supplemental Dim's: _____ Submergence In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open Drainage Material <input type="checkbox"/> Concrete <input type="checkbox"/> Earth <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Other: _____ Shape and Configuration <input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____ Depth: _____ Top Width: _____ Bottom Width: _____ Other: _____ Flow Present? <input type="checkbox"/> Yes <input type="checkbox"/> No Flow Description (if applicable): <input type="checkbox"/> Trickle: <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial
Notes: _____ _____ _____

Town of North Greenbush Outfall Inspection Form

Flow Characteristics

Flow Rate By Known Volume

Container Volume: _____ Time to Fill: _____ Calculated Flow Rate: _____

Flow Rate By Measured Flow Geometry

Flow Depth: _____ Flow Width: _____ Calculated Flow Volume: _____

Measured Length of Travel: _____ Time of Travel : _____ Calculated Flow Rate: _____

Temperature: _____ pH: _____ Ammonia: _____

Odor	<input type="checkbox"/> Sewage <input type="checkbox"/> Rancid/sour <input type="checkbox"/> Petroleum <input type="checkbox"/> Sulfide <input type="checkbox"/> Other: _____	<input type="checkbox"/> Faint <input type="checkbox"/> Easily Detected <input type="checkbox"/> Detected From Afar				
Color	<input type="checkbox"/> Clear <input type="checkbox"/> Brown <input type="checkbox"/> Gray <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Orange <input type="checkbox"/> Red <input type="checkbox"/> Other	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; border: none;">Sample in Bottle</td> <td style="width: 50%; text-align: center; border: none;">Outfall Flow</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Faint <input type="checkbox"/> Easily Detected</td> <td style="border: none;"><input type="checkbox"/> Visible in Flow</td> </tr> </table>	Sample in Bottle	Outfall Flow	<input type="checkbox"/> Faint <input type="checkbox"/> Easily Detected	<input type="checkbox"/> Visible in Flow
Sample in Bottle	Outfall Flow					
<input type="checkbox"/> Faint <input type="checkbox"/> Easily Detected	<input type="checkbox"/> Visible in Flow					
Turbidity	<input type="checkbox"/> Slight cloudiness <input type="checkbox"/> Cloudy <input type="checkbox"/> Opaque <input type="checkbox"/> Other: _____					
Floatables	<input type="checkbox"/> Sewage (Toilet Paper) <input type="checkbox"/> Suds/Froth <input type="checkbox"/> Petroleum (Sheen) <input type="checkbox"/> Other	<input type="checkbox"/> Few (origin unknown) <input type="checkbox"/> Some (indic. of origin) <input type="checkbox"/> Some (origin clear)				

Notes: _____

Physical Indicators/Characteristics Not Related to Flow

Outfall Damage	<input type="checkbox"/> Spalling/Cracking <input type="checkbox"/> Peeling Paint <input type="checkbox"/> Corrosion <input type="checkbox"/> Other	Comments:
Desposits / Stains	<input type="checkbox"/> Oily <input type="checkbox"/> Flow Line <input type="checkbox"/> Paint <input type="checkbox"/> Other	Comments:
Abnormal Vegetation	<input type="checkbox"/> Excessive <input type="checkbox"/> Inhibited <input type="checkbox"/> Other	Comments:
Poor Pool Quality	<input type="checkbox"/> Odors <input type="checkbox"/> Colors <input type="checkbox"/> Floatables <input type="checkbox"/> Sheen <input type="checkbox"/> Suds <input type="checkbox"/> Excessive Algae	Comments:
Pipe Benthic Growth	<input type="checkbox"/> Brown <input type="checkbox"/> Orange <input type="checkbox"/> Green <input type="checkbox"/> Other	Comments:

Notes: _____

Town of North Greenbush Outfall Inspection Form

Sample Data Collection

Has a sample been collected for lab analysis?

Yes No

If yes, from where was the sample taken?

Flow Pool

Has an intermittent flow trap set?

Yes No Type: _____

Notes: _____

Other

Is the structure to be characterized as an outfall?

Unlikely Potential (two or more indicators) Suspect (one or more severe indicators) Obvious

Notes: _____

Are there any non-illicit discharge concerns (trash, required repairs, etc)?

Notes: _____

Are there any illicit discharge concerns?

Notes: _____

Other general comments

Notes: _____

Exhibit 16

Local Law No.2 of the Year 2008

Illicit Discharges, Activities and Connections
to the Town of North Greenbush's
Municipal Separate Storm Sewer System

The Town Board of the Town of North Greenbush adopted Local Law No. 2 of the year 2008 at their January 10, 2008 meeting. Town of North Greenbush Local Law No. 2 of the year 2008 is intended to be a tool for the Town of North Greenbush to meet the Phase II stormwater management requirements of the National Pollutant Discharge Elimination System (NPDES) regulations, administered by New York State through the State Pollutant Discharge Elimination System (SPDES) regulations. The goal of this law is to assist the Town of North Greenbush in meeting the new federal and state guidelines for prohibiting illicit discharges to the Town of North Greenbush Municipal Separate Storm Sewer System (MS4).

The purpose of this law is to provide for the health, safety, and general welfare of the citizens of the Town of North Greenbush through the regulation of non-stormwater discharges to the MS4 to the maximum extent practicable as required by federal and state law. This law establishes methods for controlling the introduction of pollutants into the MS4 in order to comply with requirements of the SPDES General Permit for Municipal Separate Storm Sewer Systems. This law shall apply to all water entering the MS4 generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency. No person shall discharge or cause to be discharged into the MS4 any materials other than stormwater except as provided in this local law.

Copies of the 2008 law are available at the Town Clerk's Office, North Greenbush Town Hall, 2 Douglas Street, Wynantskill, New York 12198 and through the Town's website at townofng.com.

Chapter 152
SEWERS, STORM

GENERAL REFERENCES

Sewers and sewage disposal — See Ch. 151. Water — See Ch. 189.
Stormwater management — See Ch. 165. Zoning — See Ch. 197.
Subdivision of land — See Ch. 163.

ARTICLE I

**Illicit Discharges, Connections and Activities
[Adopted 1-10-2008 by L.L. No. 2-2008]****§ 152-1. Purpose; intent.**

- A. The purpose of this article is to provide for the health, safety, and general welfare of the citizens of the Town of North Greenbush through the regulation of non-stormwater discharges to the municipal separate storm sewer system (MS4) to the maximum extent practicable as required by federal and state law. This article establishes methods for controlling the introduction of pollutants into the MS4 in order to comply with requirements of the SPDES General Permit for Municipal Separate Storm Sewer Systems.
- B. The objectives of this article are:
- (1) To meet the requirements of the SPDES General Permit for Stormwater Discharges from MS4s, Permit No. GP-02-02 or as amended or revised;
 - (2) To regulate the contribution of pollutants to the MS4 since such systems are not designed to accept, process or discharge non-stormwater wastes;
 - (3) To prohibit illicit connections, activities and discharges to the MS4;
 - (4) To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this article; and
 - (5) To promote public awareness of the hazards involved in the improper discharge of trash, yard waste, lawn chemicals, pet waste, wastewater, grease, oil, petroleum products, cleaning products, paint products, hazardous waste, sediment and other pollutants into the MS4.

§ 152-2. Definitions.

Whenever used in this article, unless a different meaning is stated in a definition applicable to only a portion of this article, the following terms will have meanings set forth below:

BEST MANAGEMENT PRACTICES (BMPs) — Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

CLEAN WATER ACT — The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

CONSTRUCTION ACTIVITY — Activities requiring authorization under the SPDES permit for stormwater discharges from construction activity, GP-02-01, as amended or revised. These activities include construction projects resulting in land disturbance of one or more acres. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

DEPARTMENT — The New York State Department of Environmental Conservation.

DESIGN PROFESSIONAL — A New York State licensed professional engineer or licensed architect.

HAZARDOUS MATERIALS — Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

ILLCIT CONNECTIONS — Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the MS4, including, but not limited to:

- A. Any conveyances which allow any non-stormwater discharge including treated or untreated sewage, process wastewater, and wash water to enter the MS4 and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency; or
- B. Any drain or conveyance connected from a commercial or industrial land use to the MS4, which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

ILLCIT DISCHARGE — Any direct or indirect non-stormwater discharge to the MS4, except as exempted in § 152-5 of this article.

INDIVIDUAL SEWAGE TREATMENT SYSTEM — A facility serving one or more parcels of land or residential households, or a private, commercial or institutional facility, that treats sewage or other liquid wastes for discharge into the groundwaters of New York State, except where a permit for such a facility is required under the applicable provisions of Article 17 of the Environmental Conservation Law.

INDUSTRIAL ACTIVITY — Activities requiring the SPDES permit for discharges from industrial activities except construction, GP-98-03, as amended or revised.

MS4 — The municipal separate storm sewer system.

MUNICIPALITY — The Town of North Greenbush.

MUNICIPAL SEPARATE STORM SEWER SYSTEM — A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- A. Owned or operated by the Town of North Greenbush;
- B. Designed or used for collecting or conveying stormwater;
- C. Which is not a combined sewer; and
- D. Which is not part of a publicly owned treatment works (POTW) as defined at 40 CFR 122.2.

NON-STORMWATER DISCHARGE — Any discharge to the MS4 that is not composed entirely of stormwater.

PERSON — Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

POLLUTANT — Dredged spoil, filter backwash, solid waste, incinerator residue, treated or untreated sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand and industrial, municipal, agricultural waste and ballast discharged into water which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards.

PREMISES — Any building, lot, parcel of land, or portion of land, whether improved or unimproved, including adjacent sidewalks and parking strips.

SPECIAL CONDITIONS —

- A. Discharge compliance with water quality standards: The condition that applies where a municipality has been notified that the discharge of stormwater authorized under its MS4 permit may have caused or has the reasonable potential to cause or contribute to the violation of an applicable water quality standard. Under this condition, the municipality must take all necessary actions to ensure future discharges do not cause or contribute to a violation of water quality standards.
- B. 303(d) listed waters: The condition in the municipality's MS4 permit that applies where the MS4 discharges to a 303(d) listed water. Under this condition, the stormwater management program must ensure no increase of the listed pollutant of concern to the 303(d) listed water.
- C. Total maximum daily load (TMDL) strategy: The condition in the municipality's MS4 permit where a TMDL including requirements for control of stormwater discharges has been approved by the EPA for a water body or watershed into which the MS4 discharges. If the discharge from the MS4 did not meet the TMDL stormwater allocations prior to September 10, 2003, the municipality was required to modify

its stormwater management program to ensure that reduction of the pollutant of concern specified in the TMDL is achieved.

- D. The condition in the municipality's MS4 permit that applies if a TMDL is approved in the future by the EPA for any water body or watershed into which an MS4 discharges. Under this condition, the municipality must review the applicable TMDL to see if it includes requirements for control of stormwater discharges. If an MS4 is not meeting the TMDL stormwater allocations, the municipality must, within six months of the TMDL's approval, modify its stormwater management program to ensure that reduction of the pollutant of concern specified in the TMDL is achieved.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) STORMWATER DISCHARGE PERMIT — A permit issued by the Department that authorizes the discharge of pollutants to waters of the state.

STORMWATER — Rainwater, surface runoff, snowmelt and drainage.

STORMWATER MANAGEMENT OFFICERS (SMO) — The designated Town Engineer, or designated agent and the Building Department Coordinator are authorized by the Town of North Greenbush to enforce this article. The SMO is also designated by the Town of North Greenbush to accept and review stormwater pollution prevention plans (SWPPP) and inspect stormwater management practices.

303(d) LIST — A list of all surface waters in the state for which beneficial uses of the water (drinking, recreation, aquatic habitat, and industrial use) are impaired by pollutants, prepared periodically by the Department as required by Section 303(d) of the Clean Water Act. 303(d) listed waters are estuaries, lakes and streams that fall short of state surface water quality standards and are not expected to improve within the next two years.

TMDL — Total maximum daily load.

TOTAL MAXIMUM DAILY LOAD — The maximum amount of a pollutant to be allowed to be released into a water body so as not to impair uses of the water, allocated among the sources of that pollutant.

WASTEWATER — Water that is not stormwater and is contaminated with pollutants and is or will be discarded.

§ 152-3. Applicability.

This article shall apply to all water entering the MS4 generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency.

§ 152-4. Administration.

The Stormwater Management Officer(s) [SMO(s)] shall administer, implement, and enforce the provisions of this article. Such powers granted or duties imposed upon the authorized enforcement official may be

delegated in writing by the SMO as may be authorized by the Town of North Greenbush.

§ 152-5. Discharge prohibitions.

- A. Prohibition of illegal discharges. No person shall discharge or cause to be discharged into the MS4 any materials other than stormwater except as provided in this article. The commencement, conduct or continuance of any illegal discharge to the MS4 is prohibited except as described as follows:
- (1) The following discharges are exempt from discharge prohibitions established by this article, unless the Department or the municipality has determined them to be substantial contributors of pollutants: water line flushing or other potable water sources, landscape irrigation or lawn watering, existing diverted stream flows, rising groundwater, uncontaminated groundwater infiltration to storm drains, uncontaminated pumped groundwater, foundation or footing drains, crawl space or basement sump pumps, air conditioning condensate, irrigation water, springs, water from individual residential car washing, natural riparian habitat or wetland flows, dechlorinated swimming pool discharges, residential street wash water, water from fire-fighting activities, and any other water source not containing pollutants. Such exempt discharges shall be made in accordance with an appropriate plan for reducing pollutants.
 - (2) Discharges approved in writing by the SMO to protect life or property from imminent harm or damage, provided that such approval shall not be construed to constitute compliance with other applicable laws and requirements, and further provided that such discharges may be permitted for a specified time period and under such conditions as the SMO may deem appropriate to protect such life and property while reasonably maintaining the purpose and intent of this article.
 - (3) Dye testing in compliance with applicable state and local laws is an allowable discharge, but requires a verbal notification to the SMO prior to the time of the test.
 - (4) The prohibition shall not apply to any discharge permitted under an SPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Department, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the MS4.
- B. Prohibition of illicit connections.

- (1) The construction, use, maintenance or continued existence of illicit connections to the MS4 is prohibited.
- (2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.
- (3) A person is considered to be in violation of this article if the person connects a line conveying sewage to the municipality's MS4, or allows such a connection to continue.

§ 152-6. Failing individual sewage treatment systems prohibited.

No persons shall operate a failing individual sewage treatment system in areas tributary to the Town of North Greenbush's MS4. A failing individual sewage treatment system is one which has one or more of the following conditions:

- A. The backup of sewage into a structure.
- B. Discharges of treated or untreated sewage onto the ground surface.
- C. A connection or connections to a separate stormwater sewer system.
- D. Liquid level in the septic tank above the outlet invert.
- E. Structural failure of any component of the individual sewage treatment system that could lead to any of the other failure conditions as noted in this section.
- F. Contamination of off-site groundwater.

§ 152-7. Activities contaminating stormwater prohibited.

- A. Activities that are subject to the requirements of this section are those types of activities that:
 - (1) Cause or contribute to a violation of the municipality's MS4 SPDES permit.
 - (2) Cause or contribute to the Town of North Greenbush being subject to the special conditions as defined in § 152-2, Definitions, of this article.
- B. Such activities include failing individual sewage treatment systems as defined in this article, improper management of pet waste or any other activity that causes or contributes to violations of the municipality's MS4 SPDES permit authorization.
- C. Upon notification to a person that he or she is engaged in activities that cause or contribute to violations of the municipality's MS4 SPDES permit authorization, that person shall take all reasonable actions to correct such activities such that he or she no longer causes or

contributes to violations of the municipality's MS4 SPDES permit authorization.

§ 152-8. Use of best management practices to prevent, control and reduce stormwater pollutants.

- A. Best management practices. Where the SMO has identified illicit discharges as defined in this article or activities contaminating stormwater as defined in this article, the Town of North Greenbush may require implementation of best management practices (BMPs) to control those illicit discharges and activities.
- (1) The owner or operator of a commercial or industrial establishment shall provide, at its own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the MS4 through the use of structural and nonstructural BMPs.
 - (2) Any person responsible for a property or premises, which is, or may be, the source of an illicit discharge as defined in this article or an activity contaminating stormwater as defined in this article, may be required to implement, at said person's expense, additional structural and nonstructural BMPs to reduce or eliminate the source of pollutant(s) to the MS4.
 - (3) Compliance with all terms and conditions of a valid SPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section.
- B. Individual sewage treatment systems; response to special conditions requiring no increase of pollutants or requiring a reduction of pollutants. Where individual sewage treatment systems are contributing to the Town of North Greenbush's being subject to the special conditions as defined in this article, the owner or operator of such individual sewage treatment systems shall be required to:
- (1) Maintain and operate individual sewage treatment systems as follows:
 - (a) Inspect the septic tank annually to determine scum and sludge accumulation. Septic tanks must be pumped out whenever the bottom of the scum layer is within three inches of the bottom of the outlet baffle or sanitary tee or the top of the sludge is within 10 inches of the bottom of the outlet baffle or sanitary tee;
 - (b) Avoid the use of septic tank additives;
 - (c) Avoid the disposal of excessive quantities of detergents, kitchen wastes, laundry wastes, and household chemicals; and

- (d) Avoid the disposal of cigarette butts, disposable diapers, sanitary napkins, trash and other such items.
- (2) Repair or replace individual sewage treatment systems as follows:
 - (a) Construct in accordance with 10 NYCRR Appendix 75A to the maximum extent practicable and/or as per regulations of the Rensselaer County Health Department.
 - (b) A design professional licensed to practice in New York State shall prepare design plans for any type of absorption field that involves:
 - [1] Relocating or extending an absorption area to a location not previously approved for such.
 - [2] Installation of a new subsurface treatment system at the same location.
 - [3] Use of alternate system or innovative system design or technology.
 - (c) A written certificate of compliance, approved by the Rensselaer County Health Department, shall be submitted by the design professional to the Town of North Greenbush Building Department at the completion of construction of the repair or replacement system.

§ 152-9. Suspension of access to MS4 in emergency situations.

- A. The SMO may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, to the health or welfare of persons, or to the MS4. The SMO shall notify the person of such suspension within a reasonable time thereafter, in writing, of the reasons for the suspension. If the violator fails to comply with a suspension order issued in an emergency, the SMO may take such steps as deemed necessary to prevent or minimize damage to the MS4 or to minimize danger to persons.
- B. Suspension due to the detection of illicit discharge. Any person discharging to the Town of North Greenbush's MS4 in violation of this article may have his/her MS4 access terminated if such termination would abate or reduce an illicit discharge. The SMO will notify a violator in writing of the proposed termination of its MS4 access and the reasons therefor. The violator may petition the SMO for a reconsideration and hearing. Access may be granted by the SMO if he/she finds that the illicit discharge has ceased and the discharger has taken steps to prevent its recurrence. Access may be denied if the SMO determines in writing that the illicit discharge has not ceased or is likely to recur. A person commits an offense if the person reinstates

MS4 access to premises terminated pursuant to this section, without the prior approval of the SMO.

§ 152-10. Industrial or construction activity discharges.

Any person subject to an industrial or construction activity SPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the Town of North Greenbush prior to the allowing of discharges to the MS4.

§ 152-11. Access to facilities and monitoring of discharges.

- A. Applicability. This section applies to all facilities that the SMO must inspect to enforce any provision of this article, or whenever the authorized enforcement agency has cause to believe that there exists, or potentially exists, in or upon any premises any condition which constitutes a violation of this article.
- B. Access to facilities.
- (1) The SMO shall be permitted to enter and inspect facilities subject to regulation under this article as often as may be necessary to determine compliance with this article. If a discharger has security measures in force that require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to the SMO.
 - (2) Facility operators shall allow the SMO ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records as may be required to implement this article.
 - (3) The Town of North Greenbush shall have the right to set up, on any facility subject to this article, such devices as are necessary in the opinion of the SMO to conduct monitoring and/or sampling of the facility's stormwater discharge.
 - (4) The Town of North Greenbush has the right to require the facilities subject to this article to install monitoring equipment as is reasonably necessary to determine compliance with this article. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.
 - (5) Unreasonable delays in allowing the Town of North Greenbush access to a facility subject to this article is a violation of this article. A person who is the operator of a facility subject to this article commits an offense if the person denies the Town of North

Greenbush reasonable access to the facility for the purpose of conducting any activity authorized or required by this article.

- (6) If the SMO has been refused access to any part of the premises from which stormwater is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this article, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this article or any order issued hereunder, then the SMO may seek issuance of a search warrant from any court of competent jurisdiction.

§ 152-12. Notification of spills.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation, has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into the MS4, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of nonhazardous materials, said person shall notify the municipality in person or by telephone or facsimile no later than the next business day. Notifications in person or by telephone shall be confirmed by written notice addressed and mailed to the municipality within three business days of the telephone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

§ 152-13. Notice of violation; penalties for offenses.

A. Notice of violation.

- (1) When the municipality's SMO finds that a person has violated a prohibition or failed to meet a requirement of this article, he/she may order compliance by written notice of violation to the responsible person. Such notice may require, without limitation:
 - (a) The elimination of illicit connections or discharges;
 - (b) That violating discharges, practices, or operations shall cease and desist;
 - (c) The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
 - (d) The performance of monitoring, analyses, and reporting;

- (e) Payment of a fine; and
 - (f) The implementation of source-control or treatment BMPs.
- (2) If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.
- B. Penalties. In addition to or as an alternative to any penalty provided herein or by law, any person who violates the provisions of this article shall be guilty of a violation punishable by a fine not exceeding \$350 or imprisonment for a period not to exceed six months, or both, for conviction of a first offense; for conviction of a second offense, both of which were committed within a period of five years, punishable by a fine not less than \$350 nor more than \$700 or imprisonment for a period not to exceed six months, or both; and upon conviction for a third or subsequent offense, all of which were committed within a period of five years, punishable by a fine not less than \$700 nor more than \$1,000 or imprisonment for a period not to exceed six months, or both. However, for the purposes of conferring jurisdiction upon courts and judicial officers generally, violations of this article shall be deemed misdemeanors, and for such purpose only all provisions of law relating to misdemeanors shall apply to such violations. Each week's continued violation shall constitute a separate additional violation.

§ 152-14. Appeal of notice of violation.

Any person receiving a notice of violation may appeal the determination of the SMO to the Town Board of the Town of North Greenbush within 15 days of its issuance, which shall hear the appeal within 30 days after the filing of the appeal, and within five days of making its decision, file its decision in the office of the Town Clerk and mail a copy of its decision by certified mail to the discharger.

§ 152-15. Corrective measures after appeal.

- A. If the violation has not been corrected pursuant to the requirements set forth in the notice of violation, or, in the event of an appeal, within five business days of the decision of the municipal authority upholding the decision of the SMO, then the SMO shall request the owner's permission for access to the subject private property to take any and all measures reasonably necessary to abate the violation and/or restore the property.
- B. If refused access to the subject private property, the SMO may seek a warrant in a court of competent jurisdiction to be authorized to enter upon the property to determine whether a violation has occurred. Upon

determination that a violation has occurred, the SMO may seek a court order to take any and all measures reasonably necessary to abate the violation and/or restore the property. The cost of implementing and maintaining such measures shall be the sole responsibility of the discharger.

§ 152-16. Injunctive relief.

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this article. If a person has violated or continues to violate the provisions of this article, the SMO may petition for a preliminary or permanent injunction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

§ 152-17. Alternative remedies.

- A. Where a person has violated a provision of this article, he/she may be eligible for alternative remedies in lieu of a civil penalty, upon recommendation of the Town Attorney and concurrence of the SMO, where:
- (1) The violation was unintentional.
 - (2) The violator has no history of previous violations of this article.
 - (3) Environmental damage was minimal.
 - (4) The violator acted quickly to remedy violation.
 - (5) The violator cooperated in investigation and resolution.
- B. Alternative remedies may consist of one or more of the following:
- (1) Attendance at compliance workshops.
 - (2) Storm drain stenciling or storm drain marking.
 - (3) River, stream or creek cleanup activities.

§ 152-18. Violations deemed public nuisance.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this article is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

§ 152-19. Remedies not exclusive.

The remedies listed in this article are not exclusive of any other remedies available under any applicable federal, state or local law, and it is within

the discretion of the authorized enforcement agency to seek cumulative remedies.

Exhibit 17

Illicit Discharge Detection and Elimination Public Awareness Program

As part of the public presentation of the Town's SWMP Plan discussed in Exhibit 1, an effort will be made to highlight the Illicit Discharge Detection and Elimination Program currently being developed and implemented throughout the municipality. The discussion shall concentrate on:

- Defining an illicit discharge.
- Discussing why illicit discharges are problematic.
- The steps the Town is taking to identify illicit discharges.
- The expectations for eliminating illicit discharges.
- What residents can do to minimize the potential for illicit discharges.
- What businesses can do to minimize the potential for illicit discharges.
- How to report a suspected illicit discharge.

In addition to the public presentation, the Town will also create a flier for delivery to local residents and business, particularly those in Geographic Areas of Concern.

Illicit Discharge Detection and Elimination Program

An Illicit Discharge is the release of an undesirable pollutant into the Town's waterways

Illicit Discharges are harmful in that they can adversely affect the quality of the Town's waterways, making them unsafe for humans and wildlife

The Town is undertaking an Illicit Discharge Detection and Elimination (IDDE) Program to help identify and eliminate potentially harmful discharges into Town waterways

As a homeowner or the operator of a business within the Town you can help to minimize Illicit Discharges by being mindful of where materials from your site ultimately end up going

If there are any questions regarding Illicit Discharges, or if you think you may have noticed a potential Illicit Discharge, do not hesitate to contact the Town at (518) 283-2714 or email the Town Stormwater Management Officer at Ewestfall@northgreenbush.org

Some Common IDDE Examples



Sewer Pipe Discharging to Storm Drain



Direct Discharge to Waterway



Spill Associated with Vehicle Accident

Illicit Discharge Detection and Elimination Program

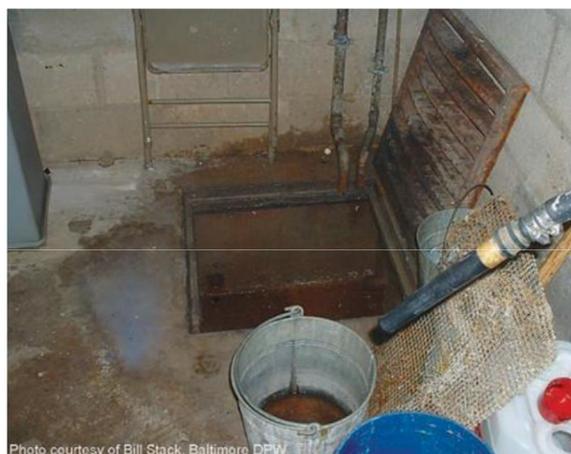


Photo courtesy of Bill Stack, Baltimore DPW

Cross-Connected Floor Drain



Dumping at Storm Drain Inlet



Outdoor Washing

Table 2: Land Uses, Generating Sites and Activities That Produce Indirect Discharges		
Land Use	Generating Site	Activity that Produces Discharge
Residential	<ul style="list-style-type: none"> • Apartments • Multi-family • Single Family Detached 	<ul style="list-style-type: none"> • Car Washing • Driveway Cleaning • Dumping/Spills (e.g., leaf litter and RV/boat holding tank effluent) • Equipment Washdowns • Lawn/Landscape Watering • Septic System Maintenance • Swimming Pool Discharges
Commercial	<ul style="list-style-type: none"> • Campgrounds/RV parks • Car Dealers/Rental Car Companies • Car Washes • Commercial Laundry/Dry Cleaning • Gas Stations/Auto Repair Shops • Marinas • Nurseries and Garden Centers • Oil Change Shops • Restaurants • Swimming Pools 	<ul style="list-style-type: none"> • Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing • Washdown of greasy equipment and grease traps
Industrial	<ul style="list-style-type: none"> • Auto recyclers • Beverages and brewing • Construction vehicle washouts • Distribution centers • Food processing • Garbage truck washouts • Marinas, boat building and repair • Metal plating operations • Paper and wood products • Petroleum storage and refining • Printing 	<ul style="list-style-type: none"> • All commercial activities • Industrial process water or rinse water • Loading and un-loading area washdowns • Outdoor material storage (fluids)
Institutional	<ul style="list-style-type: none"> • Cemeteries • Churches • Corporate Campuses • Hospitals • Schools and Universities 	<ul style="list-style-type: none"> • Building Maintenance (e.g., power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Parking Lot Maintenance (power washing) • Vehicle Washing
Municipal	<ul style="list-style-type: none"> • Airports • Landfills • Maintenance Depots • Municipal Fleet Storage Areas • Ports • Public Works Yards • Streets and Highways 	<ul style="list-style-type: none"> • Building Maintenance (power washing) • Dumping/Spills • Landscaping/Grounds Care (irrigation) • Outdoor Fluid Storage • Parking Lot Maintenance (power washing) • Road Maintenance • Spill Prevention/Response • Vehicle Fueling • Vehicle Maintenance/Repair • Vehicle Washing

Exhibit 18

Exempt Non-Stormwater Discharges

The Town of North Greenbush recognizes the potential for Non-Stormwater Discharges. The list below contains discharge sources which the Town currently considers to be exempt from Stormwater Management practices, provided they do not contain pollutants or other properties that would substantially impact drainage systems, wetlands, or water supplies.

- Any emergency activity that is immediately necessary for the protection of life, property or natural resources.
- Agricultural operations conducted as a permitted principal or accessory use, including the construction of structures where the land disturbance is less than one acre.
- Routine maintenance activities that disturb less than five acres and are performed to maintain the original lie and grade, hydraulic capacity, or original purpose of a stormwater management facility.
- Mining as defined by Town Code.
- The renovation or replacement of a septic system serving an existing dwelling or structure.
- Normal lawn and landscaping activities and maintenance in connection with an existing structure.
- Activities of an individual engaging in home gardening by growing flowers, vegetables and other plants primarily for use by that person and his or her family.
- Selective cutting of trees as defined by Town Code, except log haul roads and landing areas.
- Repairs or maintenance of any stormwater management practice or facility deemed necessary by the Stormwater Management Officer.
- Routine maintenance activities that disturb less than five acres and are performed to maintain the original lie and grade, hydraulic capacity, or original purpose of a facility.
- Cemetery Graves.
- Installation of a fence, sign, telephone and electric pole and other kinds of posts or poles.
- Springs, natural riparian habitat or wetland flows and other natural uncontaminated groundwater infiltration.
- Foundation or footing drains and basement sump pumps discharging unpolluted water.

Exhibit 19

Local Law No.1 of the Year 2008

Stormwater Management and Sediment and Erosion Control

The Town Board of the Town of North Greenbush (Town) adopted Local Law No. 1 of the Year 2008 (Local Law) at their January 10, 2008 meeting. The Local Law is intended to be a tool for the Town of North Greenbush to meet the Phase II stormwater management requirements of the National Pollutant Discharge Elimination System (NPDES) regulations, administered by New York State through the State Pollutant Discharge Elimination System (SPDES) regulations.

The purpose of the Local Law is to safeguard persons, protect property, and prevent damage to the environment in the Town of North Greenbush, New York. This law will also promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any land development activity as it relates to erosion and sedimentation control and stormwater management. The purpose of this law is to also require land development activities to conform to the substantive requirements of the NYS Department of Environmental Conservation (SPDES) General Permit for Construction Activities GP-02-01 or as amended or revised.

Based upon a recent audit of the Town's SMWP Plan by the Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (DEC), the Town is in the process of updating the Local Law. The Town's Designated Engineer (TDE) conducted a review of the existing Local Law, and while finding it to be substantially similar to the DEC Model Law, did recommend that the Local Law be updated and amended. As such, the Town has worked with the TDE to draft a new local law. Due to limited interaction between review parties and the temporary suspension of Public Hearings, the Town Board has not currently enacted the new law, but expects to be able to do so in early 2021. The existing 2008 Local Law as well as the proposed new local law are included in this Exhibit.

Copies of the 2008 law are available at the Town Clerk's Office, North Greenbush Town Hall, 2 Douglas Street, Wynantskill, New York 12198 and through the Town's website at townofng.com.

Chapter 165

STORMWATER MANAGEMENT AND EROSION AND SEDIMENT CONTROL

GENERAL REFERENCES

Sewers and sewage disposal — See Ch. 151. Water — See Ch. 189.

Storm sewers — See Ch. 152.

Zoning — See Ch. 197.

Subdivision of land — See Ch. 163.

§ 165-1. Findings of fact.

It is hereby determined that:

- A. Uncontrolled drainage and runoff associated with land development has a significant impact upon the health, safety and welfare of the community.
- B. Eroded soil endangers water resources by reducing water quality and causing the silting of streams, lakes and other water bodies, adversely affecting aquatic life.
- C. Stormwater runoff and sediment transports pollutants such as heavy metals, hydrocarbons, nutrients and bacteria to water resources, degrading water quality.
- D. Eroded soil necessitates repair and accelerates the maintenance needs of stormwater management facilities.
- E. Clearing, grading and altering natural topography during construction tends to increase erosion.
- F. Improper design and construction of drainage facilities can increase the velocity of runoff, thereby increasing stream bank erosion and sedimentation.
- G. Impervious surfaces increase the volume and rate of stormwater runoff and allow less water to percolate into the soil, thereby decreasing groundwater recharge and stream base flow.
- H. Improperly managed stormwater runoff can increase the incidence of flooding and the severity of floods that occur, endangering property and human life.
- I. Substantial economic losses can result from these adverse impacts.
- J. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of land development activities.

§ 165-2. Purpose.

The purpose of this chapter is to safeguard persons, protect property, and prevent damage to the environment in the Town of North Greenbush, New York. This chapter will also promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any land development activity as it relates to erosion and sedimentation control and stormwater management. This chapter seeks to meet these purposes by achieving the following objectives:

- A. Meet the requirements of minimum control measures four (construction site stormwater runoff control) and five (post-construction stormwater management) of the State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s), Permit No. GP-02-02 or as amended or revised.
- B. Require land development activities to conform to the substantive requirements of the NYS Department of Environmental Conservation (SPDES) General Permit for Construction Activities GP-02-01 or as amended or revised.
- C. Minimize soil erosion and sedimentation impacts on streams, water bodies, and neighboring properties.
- D. Avoid excessive and/or unnecessary tree and vegetation removal.
- E. Minimize windblown soil associated with properties being cleared and graded for development.
- F. Maintain the integrity of watercourses and sustain their hydrologic functions.
- G. Minimize increases in the magnitude and frequency of stormwater runoff to prevent an increase in flood flows and the hazards and costs associated with flooding.
- H. Minimize decreases in groundwater recharge and stream base flow to maintain aquatic life, assimilative capacity, and water supplies.
- I. Facilitate the removal of pollutants in stormwater runoff to perpetuate the natural biological function of water bodies.

§ 165-3. Applicability; exempt activities.

- A. Except as otherwise provided herein, no person shall commence or perform any land development activity, as defined herein, without the approval of a stormwater pollution prevention plan (SWPPP) by the Town of North Greenbush Stormwater Management Officer (SMO).
- B. Applicants shall also obtain all other permits required by state, federal, and local laws. Whenever the particular circumstances of proposed land development activity require compliance with special use, site

plan, or subdivision procedures of the Town of North Greenbush, the responsible board shall integrate the requirements prescribed herein as appropriate and request the Town of North Greenbush Stormwater Management Officer (SMO) to determine the adequacy of the SWPPP.

- C. Redevelopment projects, as defined herein, provide an opportunity to reduce pollutant discharges and the rate, the amount and quality of stormwater runoff leaving the redevelopment site. However, the nature of the site, particularly in an urban location, may impose constraints that prevent implementation of full post-construction compliance. Chapter 9 of the New York State Stormwater Management Design Manual sets forth the standards for compliance with water quality and quantity standards and specifications. Consideration shall be given to using alternative stormwater management practices such as rain gardens, pervious pavers, green roofs and other low-impact development techniques to reduce stormwater impacts.
- D. No SWPPP is required for the following exempt activities:
- (1) Any emergency activity that is immediately necessary for the protection of life, property, or natural resources.
 - (2) Agricultural operations conducted as a permitted principal or accessory use, including the construction of structures where the land disturbance is less than one acre.
 - (3) Routine maintenance activities that disturb less than five acres and are performed to maintain the original line and grade, hydraulic capacity, or original purpose of a stormwater management facility.
 - (4) Mining as defined herein.
 - (5) The renovation/replacement of a septic system serving an existing dwelling or structure.
 - (6) Normal lawn and landscaping activities/maintenance.
 - (7) Activities of an individual engaging in home gardening by growing flowers, vegetables and other plants primarily for use by that person and his or her family.
 - (8) Selective cutting of trees as defined herein, except log haul roads and landing areas are subject to this chapter. (Landing areas are cleared areas to which trees are hauled for their storage before being transferred off site.)
 - (9) Repairs and maintenance of any stormwater management practice or facility.

§ 165-4. Definitions.

As used in this chapter, the following terms shall have the meanings indicated:

AGRICULTURE — The use of land for sound agricultural purposes, including farming, dairy, horse boarding, pasturing, grazing, horticulture, floriculture, viticulture, timber harvesting, animal and poultry husbandry, and those practices necessary for the on-farm production, preparation, and marketing of agricultural commodities. Agriculture does not include dude ranches or similar operations.

CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (CPESC) — A person who has received training and is certified to review, inspect and/or maintain erosion and sediment control practices.

COMMENCEMENT OF CONSTRUCTION — The initial disturbance of soils associated with clearing, grading, or excavating activities, or other construction activities.

CLEARING — Any activity that removes the vegetative surface cover.

DESIGN MANUAL — The New York State Stormwater Management Design Manual, most recent version, including applicable updates, which serves as the official guide for stormwater management principles, methods and practices.

EROSION — The wearing away of the land surface by action of wind, water, gravity, or other natural forces.

EROSION AND SEDIMENT CONTROL PLAN — A set of plans prepared by or under the direction of a licensed/certified professional indicating the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction.

EROSION CONTROL MANUAL — The most recent version of the New York Standards and Specifications for Erosion and Sediment Control manual, commonly known as the "Blue Book."

GRADING — Excavation of fill, rock, gravel, sand, soil or other natural material, including the resulting conditions therefrom.

LAND DEVELOPMENT ACTIVITY — Construction activity including clearing, grading, excavating, soil disturbance, or placement of fill resulting in land disturbance of equal to or greater than one acre. Also includes activities disturbing less than one acre of total land area that are part of a larger common plan of development or sale, even though multiple separate and distinct land development activities may take place at different times on different schedules.

LICENSED/CERTIFIED PROFESSIONAL — A person currently licensed to practice engineering, or landscape architecture in New York State or who is a certified professional in erosion and sediment control (CPESC).

MINING — Any excavation subject to permitting requirements of the State Department of Environmental Conservation under the Mined Land Reclamation Law (Environmental Conservation Law, Article 23, Title 27).

NOTICE OF INTENT (NOI) — A permit application prepared and filed by an owner or operator with the Department of Environmental Conservation as an affirmation that a stormwater pollution prevention plan (SWPPP)

has been prepared and will be implemented in compliance with the State Pollution Discharge Elimination System General Permit for Stormwater Runoff for Construction Activity (GP-02-01 or as amended or revised).

OPERATOR — The person, persons, or legal entity that owns or leases the property on which the construction activity is occurring.

PERIMETER CONTROL — A barrier that prevents sediment from leaving a site by filtering sediment-laden runoff or diverting it to a sediment trap or basin.

PHASING — Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.

PROJECT (MAJOR) — Any land development activity that disturbs one acre or more, including all commercial, industrial, or mixed-use development, as well as any residential development consisting of buildings that contain two or more dwelling units, or any land development activity not classified as a minor project. The operator of a major project must submit a SWPPP that addresses water quality and quantity controls in addition to erosion and sedimentation controls as per NYSDEC regulations.

PROJECT (MINOR) — Any land development activity associated with a permitted agricultural use or single-family residential construction/subdivision that disturbs between one acre and five acres and is not discharging stormwater directly to a water body listed on NYSDEC's Section 303(d) list of impaired water bodies. Snyders Lake is currently the only water body in the Town of North Greenbush that is on this list due to phosphorous levels associated with urban runoff. The operator of a minor project must submit a SWPPP that addresses erosion and sedimentation controls as per NYSDEC regulations.

REDEVELOPMENT — Refers to the reconstruction or modification to any existing, previously developed land such as residential, commercial, industrial, institutional, or road or highway that involves soil disturbance.

SEDIMENT — Solid material, both mineral and organic, which is in suspension, is being transported, has been deposited, or has been removed from its site of origin.

SELECTIVE CUTTING — The cutting of more than 1/2 of the existing living trees measuring six-inch diameter at breast height (DBH) in an area of one acre or more, over a period of two consecutive years.

SITE — A parcel of land or a contiguous combination thereof, where grading work is performed as a single unified operation.

SITE DEVELOPMENT PERMIT — A work permit issued by the Town of North Greenbush Building Department for the construction or alteration of ground improvements and structures for the control of erosion, runoff, and grading.

SLOPES (SEVERE) — Ground areas with a slope greater than 25% covering a minimum horizontal area of 1/4 acre or 10,890 square feet and a minimum horizontal dimension of 10 feet.

SLOPES (STEEP) — Ground areas with a slope greater than 15% covering a minimum horizontal area of 1/4 acre or 10,890 square feet and a minimum horizontal dimension of 10 feet.

SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITY, GP-02-01 OR AS AMENDED OR REVISED — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to developers of construction activities to regulate disturbance of one or more acres of land.

SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM MUNICIPAL SEPARATE STORMWATER SEWER SYSTEMS GP-02-02 OR AS AMENDED OR REVISED — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to municipalities to regulate discharges from municipal separate storm sewers for compliance with USEPA-established water quality standards and/or to specify stormwater control standards.

STABILIZATION — Covering or maintaining an existing cover or soil. Cover can be vegetative (e.g., grass, trees, seed and mulch, shrubs, or turf) or nonvegetative (e.g., geotextiles, riprap, or gabions).

STABILIZATION (FINAL) — All soil-disturbing activities at the site have been completed, and a uniform perennial vegetative cover with a density of 80% has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures.

START OF CONSTRUCTION — The first land-disturbing activity associated with a development, including land preparation such as clearing, grading, and filling.

STORMWATER MANAGEMENT OFFICER (SMO) — The Town Engineer and the Building Department Coordinator are designated by the Town of North Greenbush as the SMO and are authorized to enforce this chapter. The SMO is also designated by the Town of North Greenbush to accept and review stormwater pollution prevention plans (SWPPPs) and inspect stormwater management practices.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP) — A plan for controlling stormwater runoff and pollutants from a site during and after construction activities.

SURFACE WATERS OF THE STATE OF NEW YORK — Lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial seas of the State of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction. Storm sewers and waste treatment systems, including treatment ponds or lagoons that also meet the criteria of this definition, are not waters of the state. This exclusion applies only to man-made bodies of water that neither were originally created in waters

of the state (such as a disposal area in wetlands) nor resulted from impoundment of waters of the state.

WATERCOURSE — Any body of water, including but not limited to lakes, ponds, rivers, streams, and intermittent streams.

WATERCOURSE BUFFER — A horizontal distance 50 feet away from and parallel to the high water level of a watercourse.

WETLANDS — Those areas that are inundated or saturated by surface water or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include those areas determined to be wetlands by the U.S. Army Corps of Engineers and the New York State Department of Environmental Conservation.

§ 165-5. Review and approval of stormwater pollution prevention plans.

No application for a land development activity shall be approved until the Town of North Greenbush Planning Board and/or Town of North Greenbush Building Department has received a stormwater pollution prevention plan (SWPPP) prepared in accordance with the specifications contained herein and approved by the designated Town Engineer, or designated agent.

- A. For land development activity not subject to special permit, site plan, or subdivision requirements, the designated Town Engineer, or designated agent, shall review the SWPPP to determine its completeness and conformance with the provisions herein.
- B. Within 30 days of receipt of a SWPPP, or 60 business days if the SWPPP identifies practices or designs that deviate from the prescribed standards established by this chapter, the designated Town Engineer, or designated agent, shall make a determination as to whether the SWPPP is complete. If the SWPPP is deemed incomplete, the applicant shall be notified in writing by the designated Town Engineer, or designated agent, as to the deficiencies in the SWPPP and the requirements for completeness.
- C. Within 30 days after receiving a complete SWPPP, the designated Town Engineer, or designated agent, shall notify the applicant and the Town of North Greenbush Building Department, in writing, that the Town of North Greenbush Building Department can:
 - (1) Approve the site development permit application;
 - (2) Approve the site development permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this regulation, and issue the site development permit subject to these conditions; or

- (3) Disapprove the site development permit application, indicating the reason(s) and procedure for submitting a revised application and/or submission.
- D. Failure of the designated Town Engineer, or designated agent, to act on a complete original or revised SWPPP within 30 days of receipt shall authorize the applicant to proceed in accordance with the site development plans as filed unless such time is extended by agreement between the applicant and the Town of North Greenbush Building Department. Pending preparation and approval of a revised SWPPP, land development activities shall not be allowed to proceed. Nothing herein shall relieve an applicant's need to obtain a work permit as required by Town of North Greenbush Building Department or file a notice of intent (NOI) with the New York State Department of Environmental Conservation.
 - E. For land development activity subject to special permit, site plan, or subdivision requirements, the responsible board shall incorporate the required SWPPP into the review process, allowing for public review and comment on the SWPPP. The responsible board, shall require the designated Town Engineer, or designated agent, to determine the adequacy of the SWPPP. For projects subject to subdivision requirements, final plat approval shall not be granted until the Planning Board has received a SWPPP prepared in accordance with the specifications contained herein.
 - F. In its review of the SWPPP, the responsible board may consult with the designated Town Engineer, or designated agent, the Rensselaer County Soil and Water Conservation District, the New York State Department of Environmental Conservation, or retain any other licensed/certified professionals qualified in the review and/or design of stormwater management and erosion control plans as are determined to be necessary to carry out the review of an SWPPP. Payment for the services of such professionals shall comply with § 165-16 herein.

§ 165-6. Stormwater pollution prevention plan contents.

All designs and procedures to prevent stormwater pollution as set forth within the SWPPP shall be designed in compliance with the New York Standards and Specifications for Erosion and Sediment Control and the New York State Stormwater Management Design Manual as stipulated in § 165-10 of this chapter.

- A. The SWPPP shall include the following:
 - (1) A written narrative identifying the project's scope, including the location, type, and size of the project.
 - (2) A site map/construction drawing(s) for the project, including a general location map. At a minimum, the site map should show the total site area; all improvements; areas of disturbance; areas that

will not be disturbed; locations of off-site material, waste, borrow or equipment storage areas; and location(s) of stormwater discharge(s). The specific location(s), size(s), and length(s) of each erosion and sediment control practice shall also be shown. Site maps/construction drawings shall be at a scale no smaller than one inch equals 100 feet.

- (3) A natural resources map identifying existing vegetation; on-site and adjacent off-site surface water(s), wetlands, and drainage patterns that could be affected by the construction activity; and existing and final slopes.
- (4) A description of soil(s) present at the site along with any existing data that describes the stormwater runoff characteristics at the site.
- (5) A construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing; excavation and grading; utility and infrastructure installation, and any other activity at the site that results in soil disturbance. Phasing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation. Consistent with the New York Standards and Specifications for Erosion and Sediment Control, there shall not be more than five acres of disturbed soil at any one time without prior written approval from the Department of Environmental Conservation.
- (6) A description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a pollutant source in the stormwater discharges and runoff.
- (7) A description of construction and waste materials expected to be stored on-site with updates as appropriate, and a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response.
- (8) A description of the temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control and sediment control for each stage of the project from initial land clearing and grubbing to project close-out. Depending upon the complexity of the project, the drafting of intermediate plans may be required at the close of each season.
- (9) The dimensions, material specifications (e.g., seeding mixtures and rates, types of sod, kind and quantity of mulching) and installation details for all erosion and sediment control practices, including the siting and sizing of any temporary sediment basins. Temporary

practices that will be converted to permanent control measures shall be shown.

- (10) An implementation schedule for staging temporary erosion and sediment control practices, including the timing of initial placement and the duration that each practice should remain in place.
 - (11) A maintenance schedule to ensure continuous and effective operation of the erosion and sediment control practices, including estimates of the cost of maintenance.
 - (12) Name(s) of the receiving water(s) and any existing data that describes the stormwater runoff at the site.
 - (13) Identification of the person or entities responsible for implementation of the SWPPP for each part of the site.
 - (14) A description of structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable.
 - (15) A site map/construction drawing(s) of each post-construction stormwater practice, including a description of each post-construction stormwater control practice, including specific location(s) and size(s), dimensions, material specifications and installation details.
 - (16) The New York State Stormwater Management Design Manual shall serve as the technical design standard. Deviations from this Design Manual are permitted subject to review and approval by the New York State Department of Environmental Conservation within 60 business days of receipt of a completed notice of intent (NOI).
- B. For major projects, the following shall also be provided in the SWPPP:
- (1) A hydrologic and hydraulic analysis for all structural components of the stormwater control system for the applicable design storms.
 - (2) A comparison of post-development stormwater runoff conditions with predevelopment conditions.
 - (3) Maintenance schedule to ensure continuous and effective operation of each post-construction stormwater control practice.
 - (4) Maintenance easements to ensure access to all stormwater management practices at the site for the purpose of inspection and repair.
 - (5) Easements shall be recorded on the plan and shall remain in effect with transfer of title to the property.

- (6) Inspection and maintenance agreement binding on all subsequent landowners served by the on-site stormwater management measures required by this chapter.

§ 165-7. Plan certification.

The SWPPP shall be prepared by a licensed/certified professional. The SWPPP must be signed by the professional preparing the plan and shall make the following certification:

"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 false statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law."

§ 165-8. Contractor certification.

- A. The SWPPP must clearly identify each contractor(s) and subcontractor(s) involved in soil disturbance that will implement each stormwater and erosion control measure. Each contractor and subcontractor identified in the SWPPP shall sign a copy of the following certification statement before undertaking any land development activity:

"I certify under penalty of law that I understand and agree to comply with the terms and conditions of the stormwater pollution prevention plan (SWPPP) as a condition of authorization to discharge stormwater. I also understand that the operator must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards."

- B. The certification must include the name and title of the person providing the signature; address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification is made.
- C. The certification statement(s) shall become part of the SWPPP for the land development activity.

§ 165-9. SWPPP review and amendment.

- A. The permittee shall amend the SWPPP whenever there is a significant change in design, construction, operation, or maintenance which may have a significant effect on the potential for the discharge of pollutants

to the waters of the United States and which has not otherwise been addressed in the SWPPP; or the SWPPP proves to be ineffective in:

- (1) Eliminating or significantly minimizing pollutants from sources identified in the SWPPP; or
 - (2) Achieving the general objectives of controlling pollutants in stormwater discharges from permitted construction activity.
- B. Additionally, the SWPPP shall be amended to identify any new contractor or subcontractor that will implement any measure of the SWPPP.
- C. Significant amendments or changes to the SWPPP as outlined above in Subsections A and B may be subject to review and approval in the same manner as § 165-5 herein.

§ 165-10. Design and performance standards.

- A. Grading, erosion, and sediment control practices, and waterway crossings shall meet the design criteria set forth in the most recent version of the New York Standards and Specifications for Erosion and Sediment Control published by the Empire State Chapter of the Soil and Water Conservation Society. For the design of post-construction structures, the technical standards are currently detailed in the publication New York State Stormwater Management Design Manual published by the Department of Environmental Conservation.
- B. Where stormwater management practices are not in accordance with above design and technical standards, the applicant or developer must demonstrate equivalence to the design and technical standards set forth in this section and the equivalence shall be documented and certified by a licensed/certified professional as part of the SWPPP.
- C. Cut and fill slopes shall be no greater than 2:1, except where retaining walls, structural stabilization or other methods acceptable to the designated Town Engineer, or designated agent, are used. Disturbed areas shall be restored as natural-appearing landforms, and shall blend in with the terrain of adjacent undisturbed land. Abrupt, angular transitions shall be avoided.
- D. Clearing and grading shall be substantially confined to designated building envelopes, utility easements, driveways, and parking footprint. Clearing and grading techniques that retain natural vegetation and drainage patterns, as described in the most recent version of Standards and Specifications for Erosion and Sediment Control referenced above, shall be used to the satisfaction of the responsible board. No clearing or grading shall take place within the established fifty-foot watercourse buffer area except to provide road crossings where permitted.

- E. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control devices have been installed and have been stabilized.
- F. Phasing shall be required on all sites disturbing greater than 30 acres, with the size of each phase to be established at plan review and as approved by the Planning Board. There shall not be more than five acres of disturbed soil at any one time without prior written approval from the NYS Department of Environmental Conservation.
- G. The permittee shall initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. This requirement does not apply in the following instances:
 - (1) Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable;
 - (2) Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 21 days, temporary stabilization measures need not be initiated on that portion of the site.
- H. The mere parking and moving of construction vehicles around the site does not constitute construction or earth-disturbing activity. If the permittee is not diligently pursuing the project toward completion as determined by the designated Town Engineer, or designated agent, the permittee may be issued a notice of violation (see § 165-19A) by the Town of North Greenbush Building Department and stipulate that the stabilization measures as outlined above shall be undertaken immediately to prevent site erosion.
- I. If seeding or another vegetative erosion control method is used, it shall become established within 14 days or the applicant may be required to re-seed the site or use a nonvegetative option.
- J. Special techniques that meet the design criteria outlined in the most recent version of Standards and Specifications for Erosion and Sediment Control shall be used to ensure stabilization on steep slopes or in drainageways.
- K. Soil stockpiles must be stabilized or covered at the end of each workday.
- L. The entire site must be stabilized, using a heavy mulch layer or another method that does not require germination to control erosion, at the close of the construction season.

- M. Techniques shall be employed to prevent the blowing of dust or sediment from the site.
- N. Techniques that divert upland runoff past disturbed slopes shall be employed.
- O. Adjacent properties shall be protected by the use of a vegetated buffer strip in combination with perimeter controls.
- P. In general, wetlands and watercourses should not be filled, graded or altered. The crossing of watercourses should be avoided to the maximum extent practicable.
- Q. When protection of wetlands, watercourses, trees, steep slopes or other environmentally sensitive area is required, the location shall be shown on the erosion control plan and the method of protection during construction identified (e.g., silt fence, construction fence, stakes, etc.).
- R. A vegetative buffer shall be maintained between disturbed areas and protected federal wetlands that are not proposed to be filled as part of a United States Army Corps of Engineers wetlands permit. In the case of New York State designated wetlands, the one-hundred-foot adjacent area shall not be disturbed without a New York State Department of Environmental Conservation permit.
- S. Stabilization shall be adequate to prevent erosion located at the outlets of all pipes and paved/rip-rap channels.
- T. Sediment shall be removed from sediment traps or sediment ponds whenever their design capacity has been reduced by 50%.
- U. Development should relate to site conditions and disturbance of steep slopes should be avoided. Grading should be minimized by utilizing existing topography whenever possible. Roads and driveways shall follow the natural topography to the greatest extent possible.
- V. In areas of severe slopes (exceeding 25%), land-disturbing activities are not permitted without prior approval of the designated Town Engineer, or designated agent. A twenty-five-foot buffer must be maintained between any disturbed area and the top of slopes 25% and greater.

§ 165-11. Maintenance.

- A. Maintenance easement(s). Prior to the issuance of any final approval and/or certificate of occupancy by the Town of North Greenbush Building Department on projects that have a stormwater management facility as one of the requirements, the applicant or developer must execute a maintenance easement agreement that shall be binding on all subsequent landowners served by the stormwater management facility. The easement shall provide for access to the facility at reasonable times for periodic inspection by the Town of North Greenbush personnel to ensure that the facility is maintained in proper working condition to

meet design standards and any other provisions established by this chapter. The easement shall be recorded by the grantor in the office of the Rensselaer County Clerk after approval by the Town Attorney for the Town of North Greenbush.

- B. Maintenance agreements. The Town Attorney for the Town of North Greenbush shall approve a formal maintenance agreement for stormwater management facilities binding on all subsequent landowners and recorded in the office of the Rensselaer County Clerk as a deed restriction on the property prior to the issuance of any final approval and/or certificate of occupancy by the Town of North Greenbush Building Department. The maintenance agreement shall be consistent with the following Stormwater Control Facility Maintenance Agreement:

Stormwater Control Facility Maintenance Agreement

Whereas, the Town of North Greenbush and the _____ ("facility owner") want to enter into an agreement to provide for the long-term maintenance and continuation of stormwater control measures approved by the Town of North Greenbush for the _____ named project, and

Whereas, the Town of North Greenbush and the facility owner desire that the stormwater control measures be built in accordance with the approved project plans and thereafter be maintained, cleaned, repaired, replaced and continued in perpetuity in order to ensure optimum performance of the components.

Therefore, the Town of North Greenbush and the facility owner agree as follows:

1. This agreement binds the Town of North Greenbush and the facility owner, its successors and assigns, to the maintenance provisions depicted in the approved project plans which are attached as Schedule A of this agreement.
2. The facility owner shall maintain, clean, repair, replace and continue the stormwater control measures depicted in Schedule A as necessary to ensure optimum performance of the measures to design specifications. The stormwater control measures shall include, but shall not be limited to, the following: drainage ditches, swales, dry wells, infiltrators, drop inlets, pipes, culverts, soil absorption devices and retention ponds.
3. The facility owner shall be responsible for all expenses related to the maintenance of the stormwater control measures and shall establish a means for the collection and distribution of expenses among parties for any commonly owned facilities.

4. The facility owner shall provide for the periodic inspection of the stormwater control measures, not less than once in every five-year period, to determine the condition and integrity of the measures. A professional engineer licensed by the State of New York shall perform such inspection. The inspecting engineer shall prepare and submit to the Town of North Greenbush, within 30 days of the inspection, a written report of the findings, including recommendations for those actions necessary for the continuation of the stormwater control measures.

5. The facility owner shall not authorize, undertake or permit alteration, abandonment, modification or discontinuation of the stormwater control measures except in accordance with written approval of the Town of North Greenbush.

6. The facility owner shall undertake necessary repairs and replacement of the stormwater control measures at the direction of the Town of North Greenbush or in accordance with the recommendations of the inspecting engineer.

7. The facility owner shall provide to the Town of North Greenbush, within 30 days of the date of this agreement, a security for the maintenance and continuation of the stormwater control measures in the form of a bond, letter of credit or escrow account as approved by the Town Attorney.

8. This agreement shall be recorded in the office of the Rensselaer County Clerk together with the deed for the property where the stormwater control facilities are located. This agreement shall be included in the offering plan and/or prospectus for said project if applicable.

9. If ever the Town of North Greenbush determines that the facility owner has failed to construct or maintain the stormwater control measures in accordance with the project plan or has failed to undertake corrective action specified by the Town of North Greenbush or by the inspecting engineer, the Town of North Greenbush is authorized to undertake such steps as reasonably necessary for the preservation, continuation or maintenance of the stormwater control measures and to affix the expenses thereof as a lien against the property.

10. This agreement is effective _____.

Signatures:

Facility Owner _____ Date: _____

Town of North Greenbush _____ Date: _____

C. The Town of North Greenbush Town Board, in lieu of a maintenance agreement, at its sole discretion may accept dedication of any existing or future stormwater management facility, provided such facility meets all the requirements of this chapter and includes adequate and

perpetual access and sufficient area, by easement or otherwise, for inspection and regular maintenance.

§ 165-12. Water quality standards.

Any land development activity shall not result in:

- A. An increase in turbidity that will cause a substantial visible contrast to natural conditions in surface waters of New York State; or
- B. An increase in suspended, colloidal and settleable solids that will cause deposition or impair the waters for their best uses; or
- C. Residue from oil and floating substances, nor visible oil film, or globules of grease.

§ 165-13. Maintenance during construction.

The applicant or developer of the land development activity or his/her representative shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the applicant or developer to achieve compliance with the conditions of this chapter. Sediment shall be removed from sediment traps or sediment ponds whenever their design capacity has been reduced by 50%.

§ 165-14. Erosion and sediment control inspection.

- A. The designated Town Engineer or designated agent and/or personnel from the Town of North Greenbush Building Department may require such inspections as necessary to determine compliance with this chapter and may either approve that portion of the work completed or notify the applicant wherein the work fails to comply with the requirements of this chapter and the SWPPP as approved. To obtain inspections, the applicant shall notify the Town of North Greenbush Building Department at least 48 hours before the following as required by the SWPPP:
 - (1) Start of construction and initial installation of sediment and erosion controls.
 - (2) Installation of sediment and erosion measures as site clearing and grading progresses.
 - (3) Completion of site clearing.
 - (4) Completion of rough grading.
 - (5) Completion of final grading.
 - (6) Close of the seasonal land development activity.
 - (7) Completion of final landscaping.

- (8) Successful establishment of landscaping in public areas.
- B. If any violations are found, the applicant and developer shall be notified in writing by the Town of North Greenbush Building Department of the nature of the violation and the required corrective actions. Corrective actions may include the repair/restoration of off-site impacts. No further work shall be conducted, except for site stabilization, until any violations are corrected and all work previously completed has received approval by the designated Town Engineer or designated agent and/or personnel from the Town of North Greenbush Building Department.
- C. For land development activities, the applicant shall have a qualified licensed/certified professional conduct an assessment of the site prior to the commencement of construction and certify in an inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site. Following the commencement of construction, site inspections shall be conducted by a qualified licensed/certified professional at least every seven calendar days and within 24 hours of the end of a storm event 0.5 inch or greater. The purpose of such inspections will be to determine the overall effectiveness of the plan and the need for additional control measures. During each inspection, the qualified licensed/certified professional shall record the following information:
- (1) On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next fourteen-day period;
 - (2) Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;
 - (3) Indicate all disturbed site areas that have not undergone active site work during the previous fourteen-day period;
 - (4) Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume;
 - (5) Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems and containment systems. Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and

- (6) All deficiencies that are identified with the implementation of the SWPPP.
- D. A copy of the NOI and a brief description of the project shall be posted at the construction site in a prominent place for public viewing. A copy of the SWPPP shall be retained at the site of the land development activity during construction from the beginning of construction activities to the date of final stabilization. The SWPPP and inspection reports are public documents that the operator must make available for inspection, review and copying by any person within five business days of the operator receiving a written request by such person to review the SWPPP and/or the inspection reports. Copying of documents will be done at the requester's expense. A copy of each report shall be e-mailed to the Town of North Greenbush Building Department on a weekly basis.
- E. The operator shall maintain a record of all inspection reports in a site logbook. The site logbook shall be maintained on site and be made available to the Town of North Greenbush Building Department personnel upon request. The operator shall post at the site, in a publicly accessible location, a summary of the site inspection activities on a monthly basis.
- F. The applicant or developer or his/her representative shall be on site at all times when construction or grading activity takes place and shall inspect and document the effectiveness of all erosion and sediment control practices.
- G. The designated Town Engineer or designated agent and/or Town of North Greenbush Building Department personnel shall enter the property of the applicant as deemed necessary to make regular inspections to ensure the validity of the reports filed under local law.

§ 165-15. Project completion.

- A. Inspections of stormwater management practices (SMPs). The designated Town Engineer or designated agent and/or Town of North Greenbush Building Department personnel are responsible for conducting inspections of stormwater management practices (permanent water quantity/quality improvement structures). All operators are required to submit "as built" plans certified by a professional engineer for any permanent stormwater management practices located on site after final stabilization. Final stabilization means that all soil-disturbing activities at the site have been completed and a uniform perennial vegetative cover with a density of 80% has been established or equivalent stabilization measures (such as the use of mulches, or geotextile mats) have been employed on all unpaved areas and areas not covered by permanent structures. The plan must show the final design specifications for all stormwater management facilities and must be certified by a professional engineer. Operators shall also provide the owner(s) of such structure(s) with a manual

describing the operation and maintenance practices that will be necessary in order for the structure to function as designed. The operator must also certify that the permanent structure(s) has been constructed as described in the SWPPP. This certification can be accomplished by providing to the Town of North Greenbush Building Department a copy of the notice of termination (NOT) filed with the NYSDEC.

- B. All certified "as built" plans, lands, structures, and/or appurtenances to be dedicated to the Town of North Greenbush shall be reviewed, inspected and approved by the designated Town Engineer or designated agent and/or Town of North Greenbush Building Department personnel prior to Town Board acceptance.
- C. Notice of termination (NOT). Upon certification by the operator's licensed/certified professional that a final site inspection has been conducted and that "final stabilization" has been accomplished and all stormwater management practices have been constructed as described in the SWPPP, the operator shall complete and file an NOT as proscribed by the NYSDEC and file a copy with the Town of North Greenbush Building Department to notify it that the operator has complied with this chapter and that the project is complete.

§ 165-16. Post-construction activities.

- A. Maintenance after construction. The owner or operator of permanent stormwater management practices installed in accordance with this chapter shall ensure they are operated and maintained to achieve the goals of this chapter. Proper operation and maintenance also includes, at a minimum, the following:
 - (1) A preventive/corrective maintenance program for all critical facilities and systems of treatment and control (or related appurtenances) that are installed or used by the owner or operator to achieve the goals of this chapter.
 - (2) Written procedures for operation and maintenance and training new maintenance personnel.
 - (3) Discharges from the SMPs shall not exceed design criteria or cause or contribute to water quality standard violations in accordance with § 165-12 of this chapter.
- B. Inspection of stormwater facilities after project completion. Inspection programs shall be established on a reasonable basis, including, but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more

likely than the typical discharge to cause violations of state or federal water or sediment quality standards or the SPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in drainage facilities; and evaluating the condition of drainage control facilities and other stormwater management practices.

- C. Submission of reports. The Town of North Greenbush Stormwater Management Officer may require monitoring and reporting from entities subject to this chapter as are necessary to determine compliance with this chapter.
- D. Right of entry for inspection. When any new stormwater management facility is installed on private property or when any new connection is made between private property and the public stormwater system, the landowner shall grant to the Town of North Greenbush the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection as specified in Subsection B.

§ 165-17. Performance guarantees; records.

- A. Construction completion guarantee. The applicant or developer, prior to construction, may be required by the Town of North Greenbush Building Department to provide surety, in the form, approved by the Town Attorney, of a performance bond, cash escrow, or irrevocable letter of credit, from an appropriate financial or surety institution that guarantees satisfactory completion of the project and names the Town of North Greenbush as the beneficiary. The surety shall be in an amount determined by the designated Town Engineer or designated agent based on submission of final design plans, with reference to actual construction and landscaping costs. The performance guarantee shall remain in force until the surety is released from liability by the Town Attorney of the Town of North Greenbush, provided that such period shall not be less than one year from the date of final acceptance or such other certification that the facilities have been constructed in accordance with the approved plans and specifications and that a one-year inspection has been conducted and the facilities have been found to be acceptable to the designated Town Engineer or designated agent. Per-annum interest on cash escrow deposits shall be reinvested in the account until the surety is released from liability.
- B. Maintenance guarantee. Where stormwater management and erosion and sediment control facilities are to be operated and maintained by the developer or by a corporation that owns or manages a commercial or industrial facility, the developer, prior to construction, may be required to provide the Town of North Greenbush Building Department, after being approved by the Town Attorney, with an irrevocable letter of credit from an approved financial institution or surety to ensure proper operation and maintenance of all stormwater management and erosion

control facilities both during and after construction, and until the facilities are removed from operation. If the developer or property owner fails to properly operate and maintain stormwater management and erosion control facilities, the Town of North Greenbush may, upon notification, draw upon the account to cover the costs of proper operation and maintenance, including engineering and inspection costs.

- C. Recordkeeping. The Town of North Greenbush may require entities subject to this chapter to maintain records demonstrating compliance with this chapter.

§ 165-18. Retention of licensed/certified professional; payment.

- A. The Town of North Greenbush is hereby authorized to retain licensed/certified professionals as are determined to be necessary to carry out the review of a SWPPP or to make regular or final inspections of all control measures, lands, structures, and/or appurtenances, to be dedicated to the Town of North Greenbush in accordance with the approved plan.
- B. Payment for the services of such professionals is to be made from funds deposited by the applicant with the Town of North Greenbush in escrow accounts for such purposes.
- C. It shall be the responsibility of the applicant to submit to the Town of North Greenbush a certified check(s) in an amount equal to the estimate of the licensed/certified professional for the cost of services to be rendered. Estimates shall reflect reasonable costs at prevailing rates. The Town of North Greenbush shall make payments to said professional for services rendered to it upon acceptance by the Town of North Greenbush of said service.

§ 165-19. Enforcement; penalties for offenses.

- A. Notice of violation.
 - (1) The operator and all contractors and subcontractors must comply with all conditions of a SWPPP submitted pursuant to this chapter. In the event that the Town of North Greenbush determines that a land development activity is not being carried out in accordance with the requirements of this chapter, the Town of North Greenbush Building Department Coordinator may issue a written notice of violation to the operator/landowner, applicant and all contractors/subcontractors subject to the provisions of this chapter. The notice of violation shall contain:
 - (a) The name and address of the operator/landowner, developer, or applicant.
 - (b) The address of the site or a description of the building, structure or land upon which the violation is occurring.

- (c) A statement specifying the nature of the violation.
 - (d) A description of the remedial measures necessary to bring the land development activity into compliance with this chapter and a time schedule for the completion of such remedial action.
 - (e) A statement of the penalty or penalties that can be assessed against the person to whom the notice of violation is directed.
 - (2) Within 15 days of notification of violation or as otherwise provided by the Town of North Greenbush, the violator shall take the remedial measures necessary to bring the land development activity into compliance with this chapter.
- B. Stop-work order. The Town of North Greenbush Building Department Coordinator may issue a stop-work order for violation of this chapter. Persons receiving a stop-work order shall be required to halt all land development activities, except those activities that address the violation(s) identified in the stop-work order. The stop-work order shall be in effect until the Town of North Greenbush Building Department Coordinator confirms that the land development activity is in compliance and the violation has been satisfactorily addressed. Failure to address a stop-work order in a timely manner may result in civil, criminal, and/or monetary penalties in accordance with this chapter.
- C. Violations. The Town of North Greenbush Building Department Coordinator may require entities subject to this chapter to maintain records demonstrating compliance with this chapter.
- D. Penalties. Any person violating any of the provisions of this chapter shall be deemed guilty of a misdemeanor, and each day during which any violation of any of the provisions of this chapter is committed, continued, or permitted shall constitute a separate offense. Upon conviction of any such violation, such person, partnership, or corporation shall be punished by a fine of not more than \$250 for each offense. In addition to any other penalty authorized by this section, any person, partnership, or corporation convicted of violating any of the provisions of this chapter shall be required to bear the expense of such restoration. To the extent that the noncompliance with this chapter constitutes a violation of the Clean Water Act and the Environmental Conservation Law, there may be substantial criminal, civil, and administrative penalties depending upon the nature and degree of the offense.
- E. Withholding certificate of occupancy. If any building or land development activity is installed or conducted in violation of this chapter, the Town of North Greenbush Building Department Coordinator may prevent the occupancy of said building or land.
- F. Restoration of lands. Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after notice, the Town of North Greenbush

Building Department Coordinator may take necessary corrective action, the cost of which shall become a lien upon the property until paid.

Chapter 165**STORMWATER MANAGEMENT AND EROSION AND
SEDIMENT CONTROL****GENERAL REFERENCES**

Sewers and sewage disposal — See Ch. 151.

Water — See Ch. 189.

Storm sewers — See Ch. 152.

Zoning — See Ch. 197.

Subdivision of land — See Ch. 163.

PROPOSED NEW LAW – NOT YET APPROVED BY TOWN BOARD

In accordance with Article 10 of Municipal Home Rule Law of the State of New York, the North Greenbush Town Board has the authority to enact local laws and amend local laws and for the purpose of promoting the health, safety or general welfare of the Town of North Greenbush and for the protection and enhancement of its physical environment. The North Greenbush Town Board may include in any such local law provision for the appointment of any municipal officer, employees, or independent contractor to effectuate, administer and enforce such local law.

§ 165-1. Findings of fact.

It is hereby determined that:

- A. Uncontrolled drainage and runoff associated with land development has a significant impact upon the health, safety and welfare of the community.
- B. Eroded soil endangers water resources by reducing water quality and causing the silting of streams, lakes and other water bodies, adversely affecting aquatic life.
- C. Stormwater runoff and sediment transports pollutants such as heavy metals, hydrocarbons, nutrients and bacteria to water resources, degrading water quality.
- D. Eroded soil necessitates repair and accelerates the maintenance needs of stormwater management facilities.
- E. Clearing, grading and altering natural topography during construction tends to increase erosion.
- F. Improper design and construction of drainage facilities can increase the velocity of runoff, thereby increasing stream bank erosion and sedimentation.
- G. Impervious surfaces increase the volume and rate of stormwater runoff and allow less water to percolate into the soil, thereby decreasing groundwater recharge and stream base flow.
- H. Improperly managed stormwater runoff can increase the incidence of flooding and the severity of floods that occur, endangering property and human life.

- I. Substantial economic losses can result from these adverse impacts.
- J. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of land development activities.
- K. Regulation of land development activities by means of performance standards governing stormwater management and site design will produce development compatible with the natural functions of a particular site or an entire watershed and thereby mitigate the adverse effects of erosion and sedimentation from development.

165-2

165-3

§ 165-2. Purpose.

The purpose of this chapter is to safeguard persons, protect property, and prevent damage to the environment in the Town of North Greenbush, New York. This chapter will also promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any land development activity as it relates to erosion and sedimentation control and stormwater management. This chapter seeks to meet these purposes by achieving the following objectives:

- A. Meet the requirements of minimum control measures four (construction site stormwater runoff control) and five (post-construction stormwater management) of the State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s), Permit No. GP-02-02 or as amended or revised.
- B. Require land development activities to conform to the substantive requirements of the NYS Department of Environmental Conservation (SPDES) General Permit for Construction Activities GP-02-01 or as amended or revised.
- C. Minimize soil erosion and sedimentation impacts on streams, water bodies, and neighboring properties.
- D. Avoid excessive and/or unnecessary tree and vegetation removal.
- E. Minimize windblown soil associated with properties being cleared and graded for development.
- F. Maintain the integrity of watercourses and sustain their hydrologic functions.
- G. Minimize increases in the magnitude and frequency of stormwater runoff to prevent an increase in flood flows and the hazards and costs associated with flooding.
- H. Minimize decreases in groundwater recharge and stream base flow to maintain aquatic life, assimilative capacity, and water supplies.
- I. Facilitate the removal of pollutants in stormwater runoff to perpetuate the natural biological function of water bodies.
- J. Minimize the total annual volume of stormwater runoff which flows from any specific site during and following development to the maximum extent practicable; and

- K. Reduce stormwater runoff rates and volumes, soil erosion and nonpoint source pollution, wherever possible, through stormwater management practices and to ensure that these management practices are properly maintained and eliminate threats to public safety.

§ 165-3. Applicability; exempt activities.

- A. Except as otherwise provided herein, no person shall commence or perform any land development activity, as defined herein, without the approval of a stormwater pollution prevention plan (SWPPP) by the Town of North Greenbush Stormwater Management Officer (SMO).
- B. Applicants shall also obtain all other permits required by state, federal, and local laws. Whenever the particular circumstances of proposed land development activity require compliance with special use, site plan, or subdivision procedures of the Town of North Greenbush, the responsible board shall integrate the requirements prescribed herein as appropriate and request the Town of North Greenbush Stormwater Management Officer (SMO) to determine the adequacy of the SWPPP.
- C. Redevelopment projects, as defined herein, provide an opportunity to reduce pollutant discharges and the rate, the amount and quality of stormwater runoff leaving the redevelopment site. However, the nature of the site, particularly in an urban location, may impose constraints that prevent implementation of full post-construction compliance. Chapter 9 of the New York State Stormwater Management Design Manual sets forth the standards for compliance with water quality and quantity standards and specifications. Consideration shall be given to using alternative stormwater management practices such as rain gardens, pervious pavers, green roofs and other low-impact development techniques to reduce stormwater impacts.
- D. No SWPPP is required for the following exempt activities:
- (1) Any emergency activity that is immediately necessary for the protection of life, property, or natural resources.
 - (2) Agricultural operations conducted as a permitted principal or accessory use, including the construction of structures where the land disturbance is less than one acre.
 - (3) Routine maintenance activities that disturb less than five acres and are performed to maintain the original line and grade, hydraulic capacity, or original purpose of a stormwater management facility.
 - (4) Mining as defined herein.
 - (5) The renovation/replacement of a septic system serving an existing dwelling or structure.
 - (6) Normal lawn and landscaping activities/maintenance in connection with an existing structure.

- (7) Activities of an individual engaging in home gardening by growing flowers, vegetables and other plants primarily for use by that person and his or her family.
 - (8) Selective cutting of trees as defined herein, except log haul roads and landing areas are subject to this chapter. (Landing areas are cleared areas to which trees are hauled for their storage before being transferred off site.)
 - (9) Repairs and maintenance of any stormwater management practice or facility deemed necessary by the Stormwater Management Officer.
 - (10) Routine maintenance activities that disturb less than five acres and are performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility.
 - (11) 5.7 Cemetery graves.
 - (12) 5.8 Installation of fence, sign, telephone, and electric poles and other kinds of posts or poles.
- E. All land development activities not subject to review as stated in this section shall be required to submit a Stormwater Pollution Prevention Plan (SWPPP) to the Stormwater Management Officer who shall approve the SWPPP if it complies with the requirements of this law.

§ 165-4. Definitions.

As used in this chapter, the following terms shall have the meanings indicated:

AGRICULTURE — The use of land for sound agricultural purposes, including farming, dairy, horse boarding, pasturing, grazing, horticulture, floriculture, viticulture, timber harvesting, animal and poultry husbandry, and those practices necessary for the on-farm production, preparation, and marketing of agricultural commodities. Agriculture does not include the operation of a dude ranch or similar operations, or the construction of new structures associated with agricultural activities.

APPLICANT – A property owner or agent of a property who has filed an application for a land development activity.

BUILDING – Any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal, or property, and occupying more than 100 square feet of area.

CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (CPESC) — A person who has received training and is certified to review, inspect and/or maintain erosion and sediment control practices.

CHANNEL – A natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

COMMENCEMENT OF CONSTRUCTION — The initial disturbance of soils associated with clearing, grading, or excavating activities, or other construction activities.

CLEARING — Any activity that removes the vegetative surface cover.

DEDICATION — The deliberate appropriation of property by its owner for general public use.

DEPARTMENT — The New York State Department of Environmental Conservation.

DESIGN MANUAL — The New York State Stormwater Management Design Manual, most recent version, including applicable updates, which serves as the official guide for stormwater management principles, methods and practices.

DEVELOPER — A person who undertakes land development activities.

EROSION — The wearing away of the land surface by action of wind, water, gravity, or other natural forces.

EROSION AND SEDIMENT CONTROL PLAN — A set of plans prepared by or under the direction of a licensed/certified professional indicating the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction.

EROSION CONTROL MANUAL — The most recent version of the New York Standards and Specifications for Erosion and Sediment Control manual, commonly known as the "Blue Book."

GRADING — Excavation of fill, rock, gravel, sand, soil or other material, including the resulting conditions there from.

IMPERVIOUS COVER — Those surfaces, improvements and structures that cannot effectively infiltrate rainfall, snow melt and water (e.g. building rooftops, pavement, sidewalks, driveways, etc).

INDUSTRIAL STORMWATER PERMIT — A State Pollutant Discharge Elimination System permit issued to a commercial industry or group of industries which regulates the pollutant levels associated with industrial stormwater discharges or specifies on-site pollution control strategies.

INFILTRATION — The process of percolating stormwater into the subsoil.

JURISDICTIONAL WETLAND — An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

LAND DEVELOPMENT ACTIVITY — Construction activity including clearing, grading, excavating, soil disturbance, or placement of fill resulting in land disturbance of equal to or greater than one acre. Also includes activities disturbing less than one acre of total land area that are part of a larger common plan of development or sale, even though multiple separate and distinct land development activities may take place at different times on different schedules.

LANDOWNER — The legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights in the land.

LICENSED/CERTIFIED PROFESSIONAL — A person currently licensed to practice engineering, or landscape architecture in New York State or who is a certified professional in erosion and sediment control (CPESC).

MAINTENANCE AGREEMENT – A legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of stormwater management practices.

MINING — Any excavation subject to permitting requirements of the State Department of Environmental Conservation under the Mined Land Reclamation Law (Environmental Conservation Law, Article 23, Title 27).

NONPOINT SOURCE POLLUTION – Pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

NOTICE OF INTENT (NOI) — A permit application prepared and filed by an owner or operator with the Department of Environmental Conservation as an affirmation that a stormwater pollution prevention plan (SWPPP) has been prepared and will be implemented in compliance with the State Pollution Discharge Elimination System General Permit for Stormwater Runoff for Construction Activity GP-20-001 or as amended or revised).

OPERATOR — The person, persons, or legal entity that owns or leases the property on which the construction activity is occurring.

PERIMETER CONTROL — A barrier that prevents sediment from leaving a site by filtering sediment-laden runoff or diverting it to a sediment trap or basin.

PHASING — Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.

POLLUTANT OF CONCERN – Sediment or a water quality measurement that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the land development activity.

PROJECT (MAJOR) — Any land development activity that disturbs one acre or more, including all commercial, industrial, or mixed-use development, as well as any residential development consisting of buildings that contain two or more dwelling units, or any land development activity not classified as a minor project. The operator of a major project must submit a SWPPP that addresses water quality and quantity controls in addition to erosion and sedimentation controls as per NYSDEC regulations.

PROJECT (MINOR) — Any land development activity associated with a permitted agricultural use or single-family residential construction/ subdivision that disturbs between one acre and five acres and is not discharging stormwater directly to a water body listed on NYSDEC's Section 303(d) list of impaired water bodies. Snyders Lake is currently the only water body in the Town of North Greenbush that is on this list due to phosphorous levels associated with urban runoff. The operator of a minor project must submit a SWPPP that addresses stormwater and erosion and sedimentation controls as per NYSDEC regulations.

RECHARGE – The replenishment of underground water reserves.

REDEVELOPMENT — Refers to the reconstruction or modification to any existing, previously developed land such as residential, commercial, industrial, institutional, or road or highway that involves soil disturbance.

SEDIMENT — Solid material, both mineral and organic, which is in suspension, is being transported, has been deposited, or has been removed from its site of origin.

SEDIMENT CONTROL — Measures that prevent eroded sediment from leaving the site.

SELECTIVE CUTTING — The cutting of more than 1/2 of the existing living trees measuring six-inch diameter at breast height (DBH) in an area of one acre or more, over a period of two consecutive years.

SENSITIVE AREAS — Cold water fisheries, shellfish beds, swimming beaches, groundwater recharge areas, water supply reservoirs, and habitats for threatened, endangered or special concern species.

SITE — A parcel of land or a contiguous combination thereof, where grading work is performed as a single unified operation.

SITE DEVELOPMENT PERMIT — A work permit issued by the Town of North Greenbush Building Department for the construction or alteration of ground improvements and structures for the control of erosion, runoff, and grading.

SLOPES (SEVERE) — Ground areas with a slope greater than 25% covering a minimum horizontal area of 1/4 acre or 10,890 square feet and a minimum horizontal dimension of 10 feet.

SLOPES (STEEP) — Ground areas with a slope greater than 15% covering a minimum horizontal area of 1/4 acre or 10,890 square feet and a minimum horizontal dimension of 10 feet.

SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITY, GP-02-01 OR AS AMENDED OR REVISED — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to developers of construction activities to regulate disturbance of one or more acres of land.

SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM MUNICIPAL SEPARATE STORMWATER SEWER SYSTEMS GP-02-02 OR AS AMENDED OR REVISED — A permit under the New York State Pollutant Discharge Elimination System (SPDES) issued to municipalities to regulate discharges from municipal separate storm sewers for compliance with USEPA-established water quality standards and/or to specify stormwater control standards.

STABILIZATION — Covering or maintaining an existing cover on soil. Cover can be vegetative (e.g., grass, trees, seed and mulch, shrubs, or turf) or nonvegetative (e.g., geotextiles, riprap, or gabions).

STABILIZATION (FINAL) — All soil-disturbing activities at the site have been completed, and a uniform perennial vegetative cover with a density of 80% has been established or equivalent stabilization measures (such as the use of permanent landscape mulches, rock rip-rap or washed/crushed stone) have been employed on all unpaved areas and areas not covered by permanent structures.

START OF CONSTRUCTION — The first land-disturbing activity associated with a development, including land preparation such as clearing, grading, and filling.

STORMWATER — Rainwater, surface runoff, snowmelt and drainage.

STORMWATER HOTSPOT — A land use or activity that generates higher concentration of hydrocarbons, trace metals or toxicant than are found in typical stormwater runoff, based on monitoring studies.

STORMWATER MANAGEMENT – The use of structural or non-structural practices that are designed to reduce stormwater runoff and mitigate its adverse impacts on property, natural resources and the environment.

STORMWATER MANAGEMENT FACILITY – One or a series of stormwater management practices installed, stabilized and operating for the purpose of controlling stormwater runoff.

STORMWATER MANAGEMENT OFFICER (SMO) — The Town Engineer and the Building Department Coordinator are designated by the Town of North Greenbush as the SMO and are authorized to enforce this chapter. The SMO is also designated by the Town of North Greenbush to accept and review stormwater pollution prevention plans (SWPPPs) and inspect stormwater management practices.

STORMWATER MANAGEMENT PRACTICES (SMPs) – Measures, either structural or non-structural, that are determined to be the most effective, practical means of preventing flood damage and preventing or reducing point source or nonpoint source pollution inputs to stormwater runoff and water bodies.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP) — A plan for controlling stormwater runoff and pollutants from a site during and after construction activities.

STORMWATER RUNOFF – Flow on the surface of the ground, resulting from precipitation.

SURFACE WATERS OF THE STATE OF NEW YORK — Lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial seas of the State of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction. Storm sewers and waste treatment systems, including treatment ponds or lagoons that also meet the criteria of this definition, are not waters of the state. This exclusion applies only to man-made bodies of water that neither were originally created in waters of the state (such as a disposal area in wetlands) nor resulted from impoundment of waters of the state.

WATERCOURSE — Any body of water, including but not limited to lakes, ponds, rivers, streams, and intermittent streams.

WATERCOURSE BUFFER — A horizontal distance 50 feet away from and parallel to the high water level of a watercourse.

WATERWAY – A channel that directs runoff to a watercourse or to the public storm drain.

WETLANDS — Those areas that are inundated or saturated by surface water or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include those areas determined to be wetlands by the U.S. Army Corps of Engineers and the New York State Department of Environmental Conservation.

§ 165-5. Review and approval of stormwater pollution prevention plans.

No application for a land development activity shall be approved until the Town of North Greenbush Planning Board and/or Town of North Greenbush Building Department has received a stormwater pollution prevention plan (SWPPP) prepared in accordance with the

specifications contained herein and approved by the designated Town Engineer, or designated agent.

- A. For land development activity not subject to special permit, site plan, or subdivision requirements, the designated Town Engineer, or designated agent, shall review the SWPPP to determine its completeness and conformance with the provisions herein.
- B. Within 30 days of receipt of a SWPPP, or 60 business days if the SWPPP identifies practices or designs that deviate from the prescribed standards established by this chapter, the designated Town Engineer, or designated agent, shall make a determination as to whether the SWPPP is complete. If the SWPPP is deemed incomplete, the applicant shall be notified in writing by the designated Town Engineer, or designated agent, as to the deficiencies in the SWPPP and the requirements for completeness.
- C. Within 30 days after receiving a complete SWPPP, the designated Town Engineer, or designated agent, shall notify the applicant and the Town of North Greenbush Building Department, in writing, that the Town of North Greenbush Building Department can:
 - (1) Approve the site development permit application;
 - (2) Approve the site development permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this regulation, and issue the site development permit subject to these conditions; or
 - (3) Disapprove the site development permit application, indicating the reason(s) and procedure for submitting a revised application and/ or submission.
- D. For land development activity subject to special permit, site plan, or subdivision requirements, the responsible board shall incorporate the required SWPPP into the review process, allowing for public review and comment on the SWPPP. The responsible board, shall require the designated Town Engineer, or designated agent, to determine the adequacy of the SWPPP. For projects subject to subdivision requirements, final plat approval shall not be granted until the Planning Board has received a SWPPP prepared in accordance with the specifications contained herein.
- E. In its review of the SWPPP, the responsible board may consult with the designated Town Engineer, or designated agent, the Rensselaer County Soil and Water Conservation District, the New York State Department of Environmental Conservation, or retain any other licensed/certified professionals qualified in the review and/or design of stormwater management and erosion control plans as are determined to be necessary to carry out the review of an SWPPP. Payment for the services of such professionals shall comply with § 165-16 herein.

§ 165-6. Stormwater pollution prevention plan contents.

All designs and procedures to prevent stormwater pollution as set forth within the SWPPP shall be designed in compliance with the New York Standards and Specifications for Erosion and Sediment Control and the New York State Stormwater Management Design Manual as stipulated in § 165-10 of this chapter.

- A. The SWPPP shall include the following:

- (1) A written narrative identifying the project's scope, including the location, type, and size of the project.
- (2) A site map/construction drawing(s) for the project, including a general location map. At a minimum, the site map should show the total site area; all improvements; areas of disturbance; areas that 165 will not be disturbed; locations of off-site material, waste, borrow or equipment storage areas; and location(s) of stormwater discharge(s). The specific location(s), size(s), and length(s) of each erosion and sediment control practice shall also be shown. Site maps/construction drawings shall be at a scale no smaller than one inch equals 100 feet.
- (3) A natural resources map identifying existing vegetation; on-site and adjacent off-site surface water(s), wetlands, and drainage patterns that could be affected by the construction activity; and existing and final slopes.
- (4) A description of soil(s) present at the site along with any existing data that describes the stormwater runoff characteristics at the site.
- (5) A construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing; excavation and grading; utility and infrastructure installation, and any other activity at the site that results in soil disturbance. Phasing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation. Consistent with the New York Standards and Specifications for Erosion and Sediment Control, there shall not be more than five acres of disturbed soil at any one time without prior written approval from the Department of Environmental Conservation or the Town.
- (6) A description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a pollutant source in the stormwater discharges and runoff.
- (7) A description of construction and waste materials expected to be stored on-site with updates as appropriate, and a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response.
- (8) A description of the temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control and sediment control for each stage of the project from initial land clearing and grubbing to project close-out. Depending upon the complexity of the project, the drafting of intermediate plans may be required at the close of each season.
- (9) A site map/construction drawing(s) specifying the location(s), size(s) and length(s) of each erosion and sediment control practice, material specifications (e.g., seeding mixtures and rates, types of sod, kind and quantity of mulching) and installation details for all erosion and sediment control practices, including the siting and sizing of any temporary sediment basins. Temporary practices that will be converted to permanent control measures shall be shown.

§ 165-7. Plan certification.

The SWPPP shall be prepared by a licensed/certified professional. The SWPPP must be signed by the professional preparing the plan and shall make the following certification:

"I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the NYS Department of Environmental Conservation State Pollutant Discharge Elimination System (SPDES) General Permit for Construction Activities GP-02-01 or as amended or revised. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings."

Other Environmental Permits. The applicant shall assure that all other applicable environmental permits have been or will be acquired for the land development activity prior to approval of the final stormwater design plan.

§ 165-8. Contractor certification.

- A. 2.5.1 "Each contractor and subcontractor identified in the SWPPP who will be involved in soil disturbance and/or stormwater management practice installation shall sign and date a copy of the following certification statement before undertaking any land development activity:"

"I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I am aware that there are significant penalties for submitting false information that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations."

- B. The certification must include the name and title of the person providing the signature; address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification is made.
- C. The certification statement(s) shall become part of the SWPPP for the land development activity.
- D. A copy of the SWPPP shall be retained at the site of the land development activity during construction from the date of initiation of construction activities to the date of final stabilization.

§ 165-9. SWPPP review and amendment.

- A. The permittee shall amend the SWPPP whenever there is a significant change in design, construction, operation, or maintenance which may have a significant effect on the

- G. The permittee shall initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. This requirement does not apply in the following instances:
- (1) Where the initiation of stabilization measures by the 14th day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable;
 - (2) Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 21 days, temporary stabilization measures need not be initiated on that portion of the site.
- H. The mere parking and moving of construction vehicles around the site does not constitute construction or earth-disturbing activity. If the permittee is not diligently pursuing the project toward completion as determined by the designated Town Engineer, or designated agent, the permittee may be issued a notice of violation (see § 165-19A) by the Town of North Greenbush Building Department and stipulate that the stabilization measures as outlined above shall be undertaken immediately to prevent site erosion.
- I. If seeding or another vegetative erosion control method is used, it shall become established within 14 days or the applicant may be required to re-seed the site or use a non-vegetative option.
- J. Special techniques that meet the design criteria outlined in the most recent version of Standards and Specifications for Erosion and Sediment Control shall be used to ensure stabilization on steep slopes or in drainage ways.
- K. Soil stockpiles must be stabilized or covered at the end of each workday.
- L. The entire site must be stabilized, using a heavy mulch layer or another method that does not require germination to control erosion, at the close of the construction season.
- M. Techniques shall be employed to prevent the blowing of dust or sediment from the site.
- N. Techniques that divert upland runoff past disturbed slopes shall be employed.
- O. Adjacent properties shall be protected by the use of a vegetated buffer strip in combination with perimeter controls.
- P. In general, wetlands and watercourses should not be filled, graded or altered. The crossing of watercourses should be avoided to the maximum extent practicable.
- Q. When protection of wetlands, watercourses, trees, steep slopes or other environmentally sensitive area is required, the location shall be shown on the erosion control plan and the method of protection during construction identified (e.g., silt fence, construction fence, stakes, etc.).
- R. A vegetative buffer shall be maintained between disturbed areas and protected federal wetlands that are not proposed to be filled as part of a United States Army Corps of Engineers wetlands permit. In the case of New York State designated wetlands, the one-

1. This agreement binds the Town of North Greenbush and the facility owner, its successors and assigns, to the maintenance provisions depicted in the approved project plans which are attached as Schedule A of this agreement.

2. The facility owner shall maintain, clean, repair, replace and continue the stormwater control measures depicted in Schedule A as necessary to ensure optimum performance of the measures to design specifications. The stormwater control measures shall include, but shall not be limited to, the following: drainage ditches, swales, dry wells, infiltrators, drop inlets, pipes, culverts, soil absorption devices and retention ponds.

3. The facility owner shall be responsible for all expenses related to the maintenance of the stormwater control measures and shall establish a means for the collection and distribution of expenses among parties for any commonly owned facilities.

4. The facility owner shall provide for the periodic inspection of the stormwater control measures, not less than once in every five-year period, to determine the condition and integrity of the measures. A professional engineer licensed by the State of New York shall perform such inspection. The inspecting engineer shall prepare and submit to the Town of North Greenbush, within 30 days of the inspection, a written report of the findings, including recommendations for those actions necessary for the continuation of the stormwater control measures.

5. The facility owner shall not authorize, undertake or permit alteration, abandonment, modification or discontinuation of the stormwater control measures except in accordance with written approval of the Town of North Greenbush.

6. The facility owner shall undertake necessary repairs and replacement of the stormwater control measures at the direction of the Town of North Greenbush or in accordance with the recommendations of the inspecting engineer.

7. The facility owner shall provide to the Town of North Greenbush, within 30 days of the date of this agreement, a security for the maintenance and continuation of the stormwater control measures in the form of a bond, letter of credit or escrow account as approved by the Town Attorney.

8. This agreement shall be recorded in the office of the Rensselaer County Clerk together with the deed for the property where the stormwater control facilities are located. This agreement shall be included in the offering plan and/or prospectus for said project if applicable.

9. If ever the Town of North Greenbush determines that the facility owner has failed to construct or maintain the stormwater control measures in accordance with the project plan or has failed to undertake corrective action specified by the Town of North Greenbush or by the inspecting engineer, the Town of North Greenbush is authorized to undertake such steps as reasonably necessary for the preservation, continuation or maintenance of the stormwater control measures and to affix the expenses thereof as a lien against the property.

This agreement is effective _____.

Signatures:

Facility Owner _____

Date: _____

Town of North Greenbush _____

Date: _____

- C. The Town of North Greenbush Town Board, in lieu of a maintenance agreement, at its sole discretion may accept dedication of any existing or future stormwater management facility, provided such facility meets all the requirements of this chapter and includes adequate and perpetual access and sufficient area, by easement or otherwise, for inspection and regular maintenance.

§ 165-12. Water quality standards.

Any land development activity shall not result in:

- A. An increase in turbidity that will cause a substantial visible contrast to natural conditions in surface waters of New York State; or
- B. An increase in suspended, colloidal and settleable solids that will cause deposition or impair the waters for their best uses; or
- C. Residue from oil and floating substances, nor visible oil film, or globules of grease.

§ 165-13. Maintenance during construction.

The applicant or developer of the land development activity or his/her representative shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the applicant or developer to achieve compliance with the conditions of this chapter. Sediment shall be removed from sediment traps or sediment ponds whenever their design capacity has been reduced by 50%.

§ 165-14. Erosion and sediment control inspection.

- A. The designated Town Engineer or designated agent and/or personnel from the Town of North Greenbush Building Department may require such inspections as necessary to determine compliance with this chapter and may either approve that portion of the work completed or notify the applicant wherein the work fails to comply with the requirements of this chapter and the SWPPP as approved. To obtain inspections, the applicant shall notify the Town of North Greenbush Building Department at least 48 hours before the following as required by the SWPPP:
- (1) Start of construction and initial installation of sediment and erosion controls.
 - (2) Installation of sediment and erosion measures as site clearing and grading progresses.
 - (3) Completion of site clearing.
 - (4) Completion of rough grading.
 - (5) Completion of final grading.
 - (6) Close of the seasonal land development activity.
 - (7) Completion of final landscaping.
 - (8) Successful establishment of landscaping in public areas.

- B. If any violations are found, the applicant and developer shall be notified in writing by the Town of North Greenbush Building Department of the nature of the violation and the required corrective actions. Corrective actions may include the repair/restoration of off-site impacts. No further work shall be conducted, except for site stabilization, until any violations are corrected and all work previously completed has received approval by the designated Town Engineer or designated agent and/or personnel from the Town of North Greenbush Building Department.
- C. For land development activities, the applicant shall have a qualified licensed/certified professional conduct an assessment of the site prior to the commencement of construction and certify in an inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site. Following the commencement of construction, site inspections shall be conducted by a qualified licensed/certified professional at least every seven calendar days and within 24 hours of the end of a storm event 0.5 inch or greater. The purpose of such inspections will be to determine the overall effectiveness of the plan and the need for additional control measures. During each inspection, the qualified licensed/certified professional shall record the following information:
- (1) On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next fourteen-day period;
 - (2) Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;
 - (3) Indicate all disturbed site areas that have not undergone active site work during the previous fourteen-day period;
 - (4) Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume;
 - (5) Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems and containment systems. Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and
 - (6) All deficiencies that are identified with the implementation of the SWPPP.
- D. A copy of the NOI and a brief description of the project shall be posted at the construction site in a prominent place for public viewing. A copy of the SWPPP shall be retained at the site of the land development activity during construction from the beginning of construction activities to the date of final stabilization. The SWPPP and inspection reports are public documents that the operator must make available for inspection, review and copying by any person within five business days of the operator receiving a written request by such person to review the SWPPP and/or the inspection

proscribed by the NYSDEC and file a copy with the Town of North Greenbush Building Department to notify it that the operator has complied with this chapter and that the project is complete.

§ 165-16. Post-construction activities.

- A. Maintenance after construction. The owner or operator of permanent stormwater management practices installed in accordance with this chapter shall ensure they are operated and maintained to achieve the goals of this chapter. Proper operation and maintenance also includes, at a minimum, the following:
- (1) A preventive/corrective maintenance program for all critical facilities and systems of treatment and control (or related appurtenances) that are installed or used by the owner or operator to achieve the goals of this chapter.
 - (2) Written procedures for operation and maintenance and training new maintenance personnel.
 - (3) Discharges from the SMPs shall not exceed design criteria or cause or contribute to water quality standard violations in accordance with § 165-12 of this chapter.
- B. Inspection of stormwater facilities after project completion. Inspection programs shall be established on a reasonable basis, including, but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more 165-16 165-17 likely than the typical discharge to cause violations of state or federal water or sediment quality standards or the SPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in drainage facilities; and evaluating the condition of drainage control facilities and other stormwater management practices.
- C. Submission of reports. The Town of North Greenbush Stormwater Management Officer may require monitoring and reporting from entities subject to this chapter as are necessary to determine compliance with this chapter.
- D. Right of entry for inspection. When any new stormwater management facility is installed on private property or when any new connection is made between private property and the public stormwater system, the landowner shall grant to the Town of North Greenbush the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection as specified in Subsection B.

§ 165-17. Performance guarantees; records.

- A. Construction completion guarantee. The applicant or developer, prior to construction, may be required by the Town of North Greenbush Building Department to provide surety, in the form, approved by the Town Attorney, of a performance bond, cash

escrow, or irrevocable letter of credit, from an appropriate financial or surety institution that guarantees satisfactory completion of the project and names the Town of North Greenbush as the beneficiary. The surety shall be in an amount determined by the designated Town Engineer or designated agent based on submission of final design plans, with reference to actual construction and landscaping costs. The performance guarantee shall remain in force until the surety is released from liability by the Town Attorney of the Town of North Greenbush, provided that such period shall not be less than one year from the date of final acceptance or such other certification that the facilities have been constructed in accordance with the approved plans and specifications and that a one year inspection has been conducted and the facilities have been found to be acceptable to the designated Town Engineer or designated agent. Per-annum interest on cash escrow deposits shall be reinvested in the account until the surety is released from liability.

- B. Maintenance guarantee. Where stormwater management and erosion and sediment control facilities are to be operated and maintained by the developer or by a corporation that owns or manages a commercial or industrial facility, the developer, prior to construction, may be required to provide the Town of North Greenbush Building Department, after being approved by the Town Attorney, with an irrevocable letter of credit from an approved financial institution or surety to ensure proper operation and maintenance of all stormwater management and erosion 165-17 165-19

control facilities both during and after construction, and until the facilities are removed from operation. If the developer or property owner fails to properly operate and maintain stormwater management and erosion control facilities, the Town of North Greenbush may, upon notification, draw upon the account to cover the costs of proper operation and maintenance, including engineering and inspection costs.

- C. Recordkeeping. The Town of North Greenbush may require entities subject to this chapter to maintain records demonstrating compliance with this chapter.

§ 165-18. Retention of licensed/certified professional; payment.

- A. The Town of North Greenbush is hereby authorized to retain licensed/ certified professionals as are determined to be necessary to carry out the review of a SWPPP or to make regular or final inspections of all control measures, lands, structures, and/or appurtenances, to be dedicated to the Town of North Greenbush in accordance with the approved plan.
- B. Payment for the services of such professionals is to be made from funds deposited by the applicant with the Town of North Greenbush in escrow accounts for such purposes.
- C. It shall be the responsibility of the applicant to submit to the Town of North Greenbush a certified check(s) in an amount equal to the estimate of the licensed/certified professional for the cost of services to be rendered. Estimates shall reflect reasonable costs at prevailing rates. The Town of North Greenbush shall make payments to said professional for services rendered to it upon acceptance by the Town of North Greenbush of said service.

§ 165-19. Enforcement; penalties for offenses.

A. Notice of violation.

(1) The operator and all contractors and subcontractors must comply with all conditions of a SWPPP submitted pursuant to this chapter. In the event that the Town of North Greenbush determines that a land development activity is not being carried out in accordance with the requirements of this chapter, the Town of North Greenbush Building Department Coordinator may issue a written notice of violation to the operator/landowner, applicant and all contractors/subcontractors subject to the provisions of this chapter. The notice of violation shall contain:

- (a) The name and address of the operator/landowner, developer, or applicant.
- (b) The address of the site or a description of the building, structure or land upon which the violation is occurring.
- (c) A statement specifying the nature of the violation.
- (c) A description of the remedial measures necessary to bring the land development activity into compliance with this chapter and a time schedule for the completion of such remedial action.
- (d) A statement of the penalty or penalties that can be assessed against the person to whom the notice of violation is directed.

(2) Within 15 days of notification of violation or as otherwise provided by the Town of North Greenbush, the violator shall take the remedial measures necessary to bring the land development activity into compliance with this chapter.

- B. Stop-work order. The Town of North Greenbush Building Department Coordinator may issue a stop-work order for violation of this chapter. Persons receiving a stop-work order shall be required to halt all land development activities, except those activities that address the violation(s) identified in the stop-work order. The stop-work order shall be in effect until the Town of North Greenbush Building Department Coordinator confirms that the land development activity is in compliance and the violation has been satisfactorily addressed. Failure to address a stop-work order in a timely manner may result in civil, criminal, and/or monetary penalties in accordance with this chapter.
- C. Violations. The Town of North Greenbush Building Department Coordinator may require entities subject to this chapter to maintain records demonstrating compliance with this chapter.
- D. Penalties. Any person violating any of the provisions of this chapter shall be deemed guilty of a misdemeanor, and each day during which any violation of any of the provisions of this chapter is committed, continued, or permitted shall constitute a separate offense. Upon conviction of any such violation, such person, partnership, or corporation shall be punished by a fine of not more than \$250 for each offense. In addition to any other penalty authorized by this section, any person, partnership, or corporation convicted of violating any of the provisions of this chapter shall be required to bear the expense of such restoration. To the extent that the noncompliance with this chapter constitutes a violation of the Clean Water Act and the Environmental

§ STORMWATER MANAGEMENT AND EROSION §
 Conservation Law, there may be substantial criminal, civil, and administrative penalties depending upon the nature and degree of the offense.

- E. Withholding certificate of occupancy. If any building or land development activity is installed or conducted in violation of this chapter, the Town of North Greenbush Building Department Coordinator may prevent the occupancy of said building or land.
- F. Restoration of lands. Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after notice, the Town of North Greenbush Building Department Coordinator may take necessary corrective action, the cost of which shall become a lien upon the property until paid.

SCHEDULE A

See Table 3.3 Stormwater Management Practices Acceptable for Water Quality per New York State Stormwater Management Design Manual January 2015

Group	Practice	Description
Pond	Micropool Extended Detention Pond (P-1)	Pond that treats the majority of the water quality volume through extended detention, and incorporates a micropool at the outlet of the pond to prevent sediment resuspension.
	Wet Pond (P-2)	Pond that provides storage for the entire water quality volume in the permanent pool.
	Wet Extended Detention Pond(P-3)	Pond that treats a portion of the water quality volume by detaining storm flows above a permanent pool for a specified minimum detention time.
	Multiple Pond System (P-4)	A group of ponds that collectively treat the water quality volume.
	Pocket Pond (P-5)	A stormwater wetland design adapted for the treatment of runoff from small drainage areas that has little or no baseflow available to maintain water elevations and relies on ground water to maintain a permanent pool.
Wetland	Shallow Wetland (W-1)	A wetland that provides water quality treatment entirely in a wet shallow marsh.
	Extended Detention Wetland (W-2)	A wetland system that provides some fraction of the water quality volume by detaining storm flows above the marsh surface.
	Pond/ Wetland System (W-3)	A wetland system that provides a portion of the water quality volume in the permanent pool of a wet pond that precedes the marsh for a specified minimum detention time
	Pocket Wetland (W-4)	A shallow wetland design adapted for the treatment of runoff from small drainage areas that has variable water levels and relies on groundwater for its permanent pool.
Infiltration	Infiltration Trench (I-1)	An infiltration practice that stores the water quality

		volume in the void spaces of a gravel trench before it is infiltrated into the ground.
	Infiltration Basin (I-2)	An infiltration practice that stores the water quality volume in a shallow depression, before it is infiltrated it into the ground.
	Dry Well (I-3)	An infiltration practice similar in design to the infiltration trench, and best suited for treatment of rooftop runoff.
Filtering Practices	Surface Sand Filter (F-1)	A filtering practice that treats stormwater by settling out larger particles in a sediment chamber, and then filtering stormwater through a sand matrix.
	Underground Sand Filter (F-2)	A filtering practice that treats stormwater as it flows through underground settling and filtering chambers.
	Perimeter Sand Filter (F-3)	A filter that incorporates a sediment chamber and filter bed as parallel vaults adjacent to a parking lot.
	Organic Filter (F-4)	A filtering practice that uses an organic medium such as compost in the filter, in the place of sand.
	Bioretention (F-5)	A shallow depression that treats stormwater as it flows through a soil matrix, and is returned to the storm drain system.
Open Channels	Dry Swale (O-1)	An open drainage channel or depression explicitly designed to detain and promote the filtration of stormwater runoff into the soil media.
	Wet Swale (O-2)	An open drainage channel or depression designed to retain water or intercept groundwater for water quality treatment.

Exhibit 20

SWPPP Submission and Review Process

The Town of North Greenbush (Town) currently receives, reviews, and accepts SWPPPs for construction projects based upon the following general procedure:

Submission

The SWPPP is submitted to the Town Stormwater Management Officer (SMO) for determination of the review process. The Town requires one electronic copy and two hard copies of all SWPPP documents, which shall also include a copy of SWPPP Preparer Form.

Review Process

Based upon the magnitude of the SWPPP, Town resources, schedule requirements, and other factors, the SWPPP is reviewed in one of the following three ways:

- Town Designated Engineer (TDE) Full Review

If the SMO determines that the SWPPP is to be reviewed by the TDE, the following process is used:

- The Town submits the SWPPP to the TDE for a full and thorough review.
- The TDE reviews the SWPPP and prepares a punch list of items for discussion with the SWPPP Preparer and SMO. The SMO reviews this punch list and the SWPPP in general and may offer comments, if applicable.
- The TDE and SWPPP Preparer revise the SWPPP until both parties are satisfied with the final version of the SWPPP. Input from the SMO may be incorporated in the revisions, as required.
- The TDE notifies the SWPPP Preparer and SMO, in writing, that the SWPPP is ready for Town acceptance.

- Town Designated Engineer Partial Review

If the SMO determines that the SWPPP is to be reviewed with the assistance of the TDE, the following process is used:

- The Town submits the SWPPP to the TDE for a full and thorough review.
- The TDE reviews the SWPPP and prepares a punch list of items for discussion with the SWPPP Preparer and SMO.
- The SMO reviews the punch list and the SWPPP, paying particular attention the TDE punch list items.
- The SMO and SWPPP Preparer revise the SWPPP until both parties are satisfied with the final version of the SWPPP.
- The SMO notifies the SWPPP Preparer, in writing, that the SWPPP is ready for Town acceptance.

- Town SMO Full Review

If the SMO determines that the SWPPP is to be reviewed by the Town, the following process is used:

- The Town SMO conducts a full and thorough review of the SWPPP.
- The SMO prepares a punch list of items for discussion with the SWPPP Preparer.
- The SMO and SWPPP Preparer revise the SWPPP until both parties are satisfied with the final version of the SWPPP.
- The SMO notifies the SWPPP Preparer, in writing, that the SWPPP is ready for Town acceptance.

SWPPP Acceptance

Once the SWPPP has been reviewed and revised as required, the SWPPP Preparer submits the completed Notice of Intent (NOI) form to the SMO for signature. The SMO signs the SWPPP and returns it to the preparer for submission. The SMO shall not sign an incomplete NOI form. The SWPPP Preparer may then submit the SWPPP to the New York State Department of Environmental Conservation (NYSDEC) for the issuance of a permit. At this time the, the SWPPP Owner/Operator form shall also be submitted to the Town for reference.

Documents

The following documents are attached to this Exhibit for Reference.

- The SWPPP Preparer Certification Form.
- The NOI Form.
- The SWPPP Owner/Operator Form for e-NOI submission.
- The Town's SWPPP Review Checklist.



SWPPP Preparer Certification Form

*SPDES General Permit for Stormwater
Discharges From Construction Activity
(GP-0-20-001)*

Project Site Information

Project/Site Name

Owner/Operator Information

Owner/Operator (Company Name/Private Owner/Municipality Name)

Certification Statement – SWPPP Preparer

I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the GP-0-20-001. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

First name

MI

Last Name

Signature

Date



Department of
Environmental
Conservation

NYS Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

MS4 Stormwater Pollution Prevention Plan (SWPPP) Acceptance Form

for

Construction Activities Seeking Authorization Under SPDES General Permit

*(NOTE: Attach Completed Form to Notice Of Intent and Submit to Address Above)

I. Project Owner/Operator Information

1. Owner/Operator Name:

2. Contact Person:

3. Street Address:

4. City/State/Zip:

II. Project Site Information

5. Project/Site Name:

6. Street Address:

7. City/State/Zip:

III. Stormwater Pollution Prevention Plan (SWPPP) Review and Acceptance Information

8. SWPPP Reviewed by:

9. Title/Position:

10. Date Final SWPPP Reviewed and Accepted:

IV. Regulated MS4 Information

11. Name of MS4:

12. MS4 SPDES Permit Identification Number: NYR20A

13. Contact Person:

14. Street Address:

15. City/State/Zip:

16. Telephone Number:

MS4 SWPPP Acceptance Form - continued

V. Certification Statement - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative

I hereby certify that the final Stormwater Pollution Prevention Plan (SWPPP) for the construction project identified in question 5 has been reviewed and meets the substantive requirements in the SPDES General Permit For Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). Note: The MS4, through the acceptance of the SWPPP, assumes no responsibility for the accuracy and adequacy of the design included in the SWPPP. In addition, review and acceptance of the SWPPP by the MS4 does not relieve the owner/operator or their SWPPP preparer of responsibility or liability for errors or omissions in the plan.

Printed Name:

Title/Position:

Signature:

Date:

VI. Additional Information



Owner/Operator Certification Form

SPDES General Permit For Stormwater Discharges From Construction Activity (GP-0-20-001)

Project/Site Name: _____

eNOI Submission Number: _____

eNOI Submitted by: Owner/Operator SWPPP Preparer Other

Certification Statement - Owner/Operator

I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I hereby certify that this document and the corresponding documents were prepared under my direction or supervision. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgment that I will receive as a result of submitting this NOI and can be as long as sixty (60) business days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction, and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.

Owner/Operator First Name

M.I. Last Name

Signature

Date

Town of North Greenbush Stormwater Pollution Prevention Plan Review Checklist

Project Name:		SWPPP Type:	
Project Number:		SWPPP Preparer:	
Site Address:		Contact:	
Owner/Oper.:		Phone No.:	
Contact:		E-mail Address:	
Address:		SWPPP Reviewer:	
Phone No.:		Review Date:	

General Requirements ó General Documents				
Item	Yes	No	N/A	Comments
Owner/Operator name, address and contact information				
Signed Copy of NOI				
Signature of SWPPP Preparer / Form				
Owner/Operator Certification Form				
Contractor/Subcontractor Certification Statements				
MS4 Acceptance Form, Completed				
NOT Form				

General Requirements ó Narrative Statement				
Item	Yes	No	N/A	Comments
Proposed project nature and purpose				
Existing site conditions including topography, vegetation and drainage				
Adjacent and off-site areas affected by the project				
Soils on the site and key properties				
Critical areas such as steep slopes, channels or wetlands				
Overall phasing, sequencing and stabilization plan				
Total disturbed area and, areas not to be disturbed, and soil restoration plan				

Town of North Greenbush Stormwater Pollution Prevention Plan Review Checklist

Construction Drawings				
Item	Yes	No	N/A	Comments
Vicinity Map with scale and north arrow				
Legend, scales, N arrow on plan view				
Existing and proposed topography shown with contours labeled with spot elevations in critical areas				
Scope of the plan noted in the Title Block				
Limits of clearing and grading shown, and methods of spoil disposal				
Existing vegetation delineated				
Soil boundaries shown on the existing and proposed plan views				
Existing drainage patterns, 100-year flood plain and sub-areas shown				
Runoff outfall locations identified				
Existing and proposed development facilities/improvements shown				
Location of Erosion and Sediment Control Practices as phased with construction, with dimensions and material specifications				
Phasing plan with 5-acre threshold limits shown				
Stockpile locations, staging areas, access points, and concrete trunk washout locations clearly defined				
Street profiles, utility locations, property boundaries and, easement delineations shown				
Soil Restoration Plan detailed on the site plan				

Town of North Greenbush Stormwater Pollution Prevention Plan Review Checklist

Construction Notes and Details				
Item	Yes	No	N/A	Comments
Specific sequence of operation given for each phase				
Inspection and maintenance schedule shown for the specific practices				
Design details show all dimensions and installation details necessary for construction				
Implementation schedule for E&S practices is provided				
Site pollution and construction waste management plan incorporated in the notes				
Site Inspections during construction are noted on the drawings and are in accordance with the General Permit for Stormwater Discharges from Construction Activities				

Erosion and Sediment Control Practices - General				
Item	Yes	No	N/A	Comments
Practice meets purpose and design criteria				
Standard details and construction notes are provided				
Special timing of practice noted if applicable				
Provisions for traffic crossings shown on the drawings where necessary				

Erosion and Sediment Control Practices ó Practices Controlling Runoff				
Item	Yes	No	N/A	Comments
Positive drainage is maintained with contributing drainage area shown				
Flow grades properly stabilized				
Adequate outlet or discharge condition stabilized				
Necessary dimensions, gradations, calculations, and materials shown				

Town of North Greenbush

Stormwater Pollution Prevention Plan Review Checklist

Erosion and Sediment Control Practices ó Practices Stabilizing Soil				
Item	Yes	No	N/A	Comments
Seeding rates and areas properly shown on the drawings				
Mulch materials and rates specified on the drawings				
Sequencing and timing provisions limit soil exposure to 7 to 14 days as appropriate for Erosion and Sediment Control				
Rolled Erosion Control Products (RECPs) used are specified to location and appropriate weight/tie down				
All soil seed bed preparation and amendments are specified on the drawings or in the specifications				
The seeding dates are specified to cover the entire year for both temporary and permanent seedings				
Maximum created slopes are no steeper than 2 foot horizontal to 1 foot vertical with Cut and Fill slopes shown				

Erosion and Sediment Control Practices ó Practices Controlling Sediment				
Item	Yes	No	N/A	Comments
Sediment traps/basins are sized in accordance with criteria				
The contributing drainage area is shown on the grading plan				
All scaled dimensions and volumes are shown on the plan				
Maintenance requirements and clean out elevations established for all sediment control practices (50% capacity)				
All access points of the project are shown to be stabilized				
Storm drain inlets adequately protected				
Buffer filter strips are appropriately sited and installed				
Silt fences are shown on the contour lines with no more than one quarter acre per 100 foot drainage to it				
Temporary sediment traps are not being used at locations of future stormwater infiltration facilities				

Town of North Greenbush

Stormwater Pollution Prevention Plan Review Checklist

Dewatering devices for traps and basins are adequately designed with details shown on the plans				
Geotextile filter bags are properly sited, sized, and have their maintenance requirements detailed on the drawings				
Turbidity curtains are properly located with installation, anchoring, and maintenance details shown on the plans				

Exhibit 21

SWPPP Pre-Construction Meeting and Training Verification

Pre-Construction Kickoff Meeting

Prior to commencing construction activities governed by the Town's MS4 program, a Pre-Construction Kickoff Meeting will be held between the Town and the Applicant/Developer. The meeting shall be attended by at least the following personnel:

- The Town Engineer or Stormwater Management Officer, the Town Building Inspector, and/or a TDE representative. One of these individuals shall serve as the facilitator for the meeting.
- The Developer or Developer's representative.
- The Project Site Foreman or Project Site Foreman's representative.
- The Site Foreman or Site Foreman's representative for any subcontractors performing work related to SWPPP activities.
- The Developer's SWPPP Inspector.

Attendees shall register their Name, Title, Company, Phone Number, and E-Mail Address on a sign-in sheet at the start of the meeting.

The Meeting Agenda shall include, at minimum, the following items:

- Construction Prerequisites. This includes items such as the NYSDEC Permit Acknowledgement Letter, Stormwater Management Facility Deed Covenant and others documents as may apply.
- SWPPP Responsible Parties and Certifications. This applies, at a minimum, to the Owner/Operator, Contractor, and Qualified Inspector.
- The Town MS4 Program and Minimum Control Measure (MCM) Program. This shall include the designation of responsible parties, oversight requirements, inspection frequency, the SWPPP and SWPPP amendments, and the NOT, as well as notifications, actions and penalties for non-compliance. The SMO or qualified designee shall review the SWPPP with the attendants and shall express the expectations of the Town with regards to the SWPPP
- Site Construction Drawings and Specifications Review. This is intended to establish the overall construction scope and schedule and in particular the details that relate to the approved SWPPP.
- Notice of Termination. Discussion of completed work, final inspections and submission of paperwork to Town and NYSDEC.

Construction Site Operator Training and Documentation

Construction Site Operators are required to have the following training and documentation in order to be able to conduct site inspections:

- Training, such as the New York State Department of Environmental Conservation (NYSDEC) 84-Hour Erosion and Sediment Control Training or approved equal. The training shall be up-to-date and a copy of the Training Certificate shall be on file with the Town Building Department.

- A wallet card indicating proof of training, which must be carried on-person to the inspection site.
- A picture ID, which must be carried on-person to the inspection site.

A copy of a sample Meeting Sign-in Sheet and Agenda developed by the TDE and used by the Town is attached to this document.

MS4 Program
MCM 4: Construction Site Runoff Control

Project: _____ **NYR** _____
Pre-Construction Meeting Checklist

Attendees Sign In:

_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail
_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail
_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail
_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail
_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail
_____	_____	_____	_____	_____
Name	Title	Company	Phone Number	E-Mail

Project: _____ **NYR** _____
Pre-Construction Meeting Checklist/Agenda

Topics to Discuss /Agenda:

1. Meeting Sign In for attendees.
2. Introductions.
 - Names/Company/Project Roles
3. Construction Prerequisites.
 - Copy of NYS DEC Permit Acknowledgement Letter
 - Storm Water Management Facility Deed Covenant
 - Other: _____
4. SWPPP Responsible Parties & Certifications.
 - SWPPP Responsible Parties Contact Information
 - Owner/Operator: _____
 - Emergency 24-hr contact/cell #s _____
 - Duty to commence implementation of corrective actions within a business day.
 - Copy of Owner/Operators Certification Statement
 - Delegation of Authority (if appropriate): _____
 - Contractor: _____
 - Emergency 24-hr contact/cell #s _____
 - Duty to commence implementation of corrective actions within a business day.
 - Trained Contractor: _____
 - Daily Inspections
 - On-site during earth disturbing activities
 - Provide the following to the Town SMO & Town Designated Engineer and maintain on-site in SWPPP documents:
 - Copy of Contractor's Certification Statement
 - Copy of Sub-Contractor's Certification Statements
 - Copy of Training Cards (certification must be within 3 yrs of date)

MS4 Program MCM 4: Construction Site Runoff Control

- Qualified Inspector:

 - Maintaining the SWPPP Documents on site per the General Permit including but not limited to : The General Permit, NOI, NOI Acknowledgment Letter, SWPPP, MS4 SWPPP Acceptance form, inspection reports, and all documentation necessary
 - Pre-construction assessment of installed E&SC's.
 - Routine Inspections & Reports in compliance with the General Permit (see permit for list of report content)
 - Reduced in accordance with the General Permit (requested in writing in advance and only if approved in writing by MS4)
 - Copies of reports via email to Town & Designated Engineer for the MS4.
- 5. Town MS4 Program MCM 4 Construction Site Runoff Control
 - The Town (Stormwater Management Officer); and
 - The Laberge Group (Town Designated Engineer)
 - Oversight, routinely with increased frequency as needed to ensure compliance with the General Permit.
 - Approval of reduced inspection frequency, amendments to the SWPPP, NOT.
 - Revocation of General Permit [GP-0-15-002 Part II.C.4], stop work, require individual permit, fines (GP-0-15-002 Part VII.C) up to \$37,500 per day per violation.
- 6. Site Construction Drawings and Specifications Review.
 - Construction Drawings and Specifications
 - Erosion and Sediment Control Plan and Details
 - Sequence of Construction, Erosion and Sediment Control Plan and Details,
 - Schedule of Construction
 - Additional Site Specific Issues
 - Additional Site Specific Issues
- 7. Notice of Termination (with certified copy of the Stormwater Maintenance Agreement)
 - Completed and forwarded to the Town Designated Engineer for review and recommendation to Town for Approval.
 - Town Approval.
 - Town Designated Engineer Files with NYS DEC copies all parties listed.

Exhibit 22

SWPPP Inspection and Enforcement Policy

1. Purpose

The purpose of this stormwater construction inspection document is to provide guidance to inspectors, staff, and contractors in the procedures and expectations for conducting Stormwater Pollution Prevention Plan (SWPPP) compliance inspections at construction sites within the Town of North Greenbush (Town). The guide focuses primarily on the Town's role in the inspection procedure, but does address other inspections performed by third-party entities.

2. Compliance Inspection Types

There are three types of inspections addressed within this Guide, as follows:

Comprehensive Inspections. Comprehensive Inspections are intended to be thorough and are designed to verify that the permittee is in compliance with applicable regulatory requirements, effluent controls, compliance schedules and other measures outlined in the project SWPPP. This type of inspection involves the review of records; visual observations; evaluations of management practices, effluents and receiving waters; the formal documentation of inspection findings; notification of permittee of any observed deficiencies; and the expectation of the timeframe in which deficiencies are to be addressed. The Comprehensive Inspection is typically conducted by a qualified Town or Town Designated Engineer (TDE) representative for compliance with the Town's MS4 program. A copy of the Town's SWPPP Inspection Form and associated cover letter is attached to this Exhibit.

Reconnaissance Inspections. Reconnaissance Inspections are less formal than Comprehensive Inspections and are typically conducted on a smaller scale. This type of inspection may be undertaken in response to known or suspected violations, public complaints, regulatory requirement violations, or as a follow-up to verify actions that were to be undertaken as part of previous inspections. As with Comprehensive Inspections, Reconnaissance Inspections are typically conducted by a Town or TDE representative.

Self-Inspections. When required by the State Discharge Elimination System (SPDES) Permit or otherwise specified by the Town, the site owner/operator shall contract a qualified professional, approved by the Town, to conduct Self-Inspections at the project site. For Self-Inspections, the qualified professional shall determine whether or not the site is being managed in accordance with the SWPPP and whether or not the SWPPP's recommended erosion and sediment control measures are effective. If items are out of compliance with the SWPPP, or SWPPP erosion and sediment controls are not effective, the qualified professional inspecting the site recommends corrections to the owner/operator and notifies the Town of these items.

The Town shall not conduct Self-Inspections on behalf of the owner/operator.

Inspections may be announced or unannounced, with unannounced inspections being preferred as long as it is safe to do so.

3. Inspector/Contractor Training and Documentation

Inspectors, whether working for the Town, a TDE representative, or a third party, are required to have the following training and documentation in order to be able to conduct site inspections:

- Training, such as the New York State Department of Environmental Conservation (NYSDEC) 8-Hour Erosion and Sediment Control Training or approved equal. The training shall be up-to-date and a copy of the Training Certificate shall be on file with the Town Building Department.
- A wallet card indicating proof of training, which must be carried on-person to the inspection site.
- A picture ID, which must be carried on-person to the inspection site.

4. Inspection Frequency and Prioritization

Inspections shall be conducted at the minimum following frequencies:

- Comprehensive Inspections shall be completed by the Town or the TDE representative at least once every 30 days for sites subject to Self-Inspections. For sites without Self-Inspections, Comprehensive Inspections shall be completed at least every 7 days for sites with under 5 acres of disturbance; twice every seven days for sites with over five acres of disturbance; and following a rainfall event of at least one-half inch.
- There is no frequency requirement for Reconnaissance Inspections.
- Self-Inspections shall be completed at least every 7 days for sites with under 5 acres of disturbance; twice every seven days for sites with over five acres of disturbance; and following a rainfall event of at least one-half inch.

Barring any readily evident or unique site conditions, inspections shall be prioritized and conducted in an order of precedence based upon the following general criteria:

- Sites where a rainfall event of at least one-half inch has occurred to verify the continued integrity of stormwater management components.
- New construction sites in which SWPPP measures are being initially installed and stabilized.
- Sites with a history of SWPPP violations.
- Sites in close proximity to a NYSDEC or ACOE wetland or adjacent to substantial waterbodies.
- Sites over 5 acres in area.

On the Town of North Greenbush Stormwater Management Project Spreadsheet, projects shall be identified as having one of the following Priorities:

- **High:** This category includes new construction sites in which SWPPP measures are being initially installed and stabilized; active sites with a history of SWPPP violations; sites in close proximity to a DEC or ACOE wetland or adjacent to substantial waterbodies; sites over 5 acres in area; and sites otherwise deemed as High Priority by the Town. Since the rainfall event criteria can be applied to any site, it is not in itself a reason to identify a particular site as High Priority.
- **Medium:** This category includes all other sites engaged in standard construction activities and not otherwise covered by one of the other Priority categories.
- **Low:** This category includes sites on which work is not currently occurring and the site is stabilized.

For sites in which NYSDEC lists the permit coverage as Terminated, no priority is assigned.

5. Pre-Inspection Preparation

The following items are to be completed prior to traveling to the construction site for an inspection:

- Notify the office of the time and location of the upcoming inspection.
- Coordinate the inspection with any other regulatory or oversight authorities they may be conducting inspections at the job site, as applicable.
- Verify that proof of credentials are on your person, including a photographic ID and any training certificates (wallet cards) associated with the tasks to be performed.
- Prepare the Field Inspection Form with static information such as the inspector's name, the project location, the permit number and other such details as can be entered prior to traveling to the site. A copy of the inspection form is included with this document.
- Review the SWPPP, past inspection reports, phasing plan, construction sequence, Consent Orders, site-specific issues and other pertinent project paperwork and drawings.
- Assemble any personal protective equipment, monitoring equipment, tape measures, cameras and other tools or apparatus as may be required to conduct the inspection or enter the job site.

6. On-Site Inspection Process

The following general procedure shall be used while conducting Comprehensive Inspections:

- Notify the Construction Manager or designated Person-in-Charge identified during the preconstruction kickoff meeting that an inspection is taking place.
- Complete the remainder of the Field Inspection Form header sections for specific site conditions at the time of the inspection such as times and conditions, including current weather as well as weather conditions since the last inspection, if noteworthy.
- Review on-site records. At a minimum, copies of the following items are to be kept in a known location at the project site and should be verified:
 - Construction stormwater permit.
 - Notice of Intent (NOI).
 - SWPPP.
 - Prior Town inspection reports.
 - Prior Self-Inspection reports.
- Conduct a site walk. At a minimum, the following items should be visually inspected and noted, with supporting digital photographs as required:
 - The location and characteristics of waters entering the site (receiving waters).
 - The location and characteristics of waters leaving the site and any descriptions or evidence of previous or ongoing discharges of sediment or other pollutants from the site.
 - Stabilized construction entrances and concrete washout areas.
 - Material storage or stockpiling areas.
 - Disturbed areas not currently being worked.
 - Dewatering operations.
 - Sloped areas, particularly those under construction and requiring stabilization.
 - The installation and maintenance of stormwater control measures or best management practices (BMPs) listed in the SWPPP such as silt fencing, storm drain inlet protection, swales, check dams and other measures.
 - Locations where BMPs are installed but are failing to operate as designed or intended.
 - Locations where additional BMPs are needed but do not currently exist.

7. Post-Inspection Exit Interview

When the inspection is complete, conduct a post-inspection exit interview with the site foreman or designee. The following items shall be discussed:

- Noted deficiencies for installed BMPs requiring maintenance, upkeep or restoration and the expected timeline to address the issues.
- The contractor's plan for addressing the noted deficiencies. It should be noted that, for deficiencies and design shortcomings, the Town does not want to dictate the action to

be taken. Rather, it is the job of the site manager or their design engineer to propose solutions to noted deficiencies.

- The schedule for initiating and completing work for the noted deficiencies. Work on deficient areas is to begin within 24 hours and be completed as quickly as possible, within reason.
- Shortcomings in the BMPs that require engineering design changes or additions to the SWPPP and the expected timeline to address the items.
- Consequences for not addressing items in a timely manner.

If possible, a copy of the inspection checklist should be signed by the site manager as an acknowledgement of the items discussed and intended path forward.

8. Post-Inspection Documentation

Following a Comprehensive Inspection or Reconnaissance Inspection, the inspector should take the following steps once returning to the office:

- Compile the inspection notes and photographs into a single, multi-page document and scan the document electronically.
- Use the Stormwater Compliance Inspection Cover Letter Template (included as part of this exhibit) to create a cover letter addressed to the Owner/Operator pertaining to the specific inspection performed.
- Send a copy of the cover letter and inspection report to the site manager or other Owner/Operator contact with a read receipt request. If the inspection is conducted on behalf of the Town by a TDE representative, the Town Building Department is to be copied on the e-mail. This should be done the day of the inspection, but no later than two days following the inspection.
- For Comprehensive Inspections in which a deficiency has been noted, the cover letter shall indicate such and should also note or request a response to the following:
 - The recipient is to indicate the manner in which the deficiency will be rectified, if not already addressed by the SWPPP.
 - The Town expects work associated with addressing the deficiency to begin within 24 hours of the notification of the deficiency, and for the contractor to indicate why this will not occur.
 - The contractor's estimated time of completion for work to address the deficiency.
 - The potential Town's next step(s) in the event that the deficiency is not addressed.

It is understood that this may be redundant to items discussed in the Post-Inspection Exit Interview. However, this will reiterate the fact that the Town is looking to move to a policy that steps away from just verbal communication to a more formal, documented system, particularly for items requiring attention.

- Place a copy of the inspection report and photographs in the Town's Inspection Binder and update the Stormwater Management Project Spreadsheet.

Following a Self-Inspection, the inspector should take the following steps once returning to the office, as they relate to the Town, in addition to any internal procedures:

- Send an electronic copy of the inspection to the Building Department. This should be done the day of the inspection, but no later than the following morning.
- For Self-Inspections in which a deficiency has been noted, the e-mail header line and body of the e-mail should indicate such and should also note the following:
 - The manner in which the deficiency will be addressed.
 - The contractor's estimated time to start and complete work to address the deficiency. (Note that the Town expects work to rectify the deficiency to begin within 24 hours of the notification of the deficiency).
- Place a copy of the inspection report and photographs at the site's SWPPP box. For sites with deficiencies, this is to be done within 24 hours. If no deficiencies were noted, this report and photographs shall be placed in the site's SWPPP box within 72 hours.

9. Enforcement Escalation

The operator/landowner, applicant, site manager and any contractor/subcontractor (Contractor) working within the Town of North Greenbush (Town) must comply with all conditions of a SWPPP submitted pursuant to the Town's Local Law. In the event that the Town determines that a land development activity is not being carried out in accordance with the requirements of this Local Law, the Building Inspector, Zoning Officer, Town Engineer, or an appointed designee (Officer), shall take the following steps to address the violation:

- **Initial Notification:** The Contractor will be notified of the violation(s) and told that work for addressing the violation(s) is to begin within 24 hours and shall be completed as quickly as is practicable. This communication should be in writing, but may be verbal, and if so, is to be documented in the Officer's daily notes.
- **Second Notification/Notice of Violation:** If the Contractor fails to address the Initial Notification item(s), the Officer shall issue a written Notice of Violation to the Contractor subject to the provisions of this local law. The Notice of Violation shall contain:
 - The name and address of the operator/landowner, developer, or applicant;

- The address of the site or a description of the building, structure or land upon which the violation is occurring;
- A statement specifying the nature of the violation;
- A description of the remedial measures necessary to bring the land development activity into compliance with this local law and a time schedule for the completion of such remedial action; and
- A statement of the penalty or penalties that can be assessed against the person to whom the notice of violation is directed.

Within fifteen (15) days of notification of violation, or as otherwise provided by the Town, the violator shall take the remedial measures necessary to bring the land development activity into compliance with this local law.

- **Stop Work Order:** If the Contractor fails to respond to the Town's request to remedy violations, a Stop Work Order may be issued. Persons receiving a stop work order shall be required to halt all land development activities, except those activities that address the violation(s) identified in the stop work order. The Town reserves the right to keep the Stop Work Order in place for all work on the site other than items associated with addressing the violation or may lift the Stop Work Order entirely if work on the violation proceeds at an acceptable pace. It shall be conveyed to the Contractor that failure to address a Stop Work Order in a timely manner may result in civil, criminal, and/or monetary penalties in accordance with this Local Law.
- **Fines and Penalties:** The Town may issue a fine for the failure to address violations. Additionally, any person violating any of the provisions of this Local Law may be deemed guilty of a misdemeanor and each day during which any violation of any of the provisions of this Local Law is committed, continued, or permitted, shall constitute a separate offense. Upon conviction of any such violation, such person, partnership, or corporation may be punished by a fine of not more than \$250 for each offense. In addition to any other penalty authorized by this section, any person, partnership, or corporation convicted of violating any of the provisions of this Local Law shall be required to bear the expense of such restoration.
- **Regulatory Agency Involvement:** The Town may choose to involve the governing regulatory agency, such as NYSDEC or ACOE, in the enforcement procedure. To the extent that the noncompliance with this Local Law constitutes a violation of the New York State Environmental Conservation Law, there may be substantial criminal, civil, and administrative penalties depending upon the nature and degree of the offense. Any penalties levied by regulatory agencies will be independent of penalties levied by the Town.
- **Withholding Certificate of Occupancy:** If any building or land development activity is installed or conducted in violation of this Local Law, the Officer may prevent the occupancy of said building or land.

- Restoration of Lands: Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after notice, the Town may take necessary corrective action, the cost of which shall become a lien upon the property until paid.



XXXX XX, 2021

Contractor Name
Address
Address
Address

Re: Notice of Town SWPPP Oversight Inspection
Project Name, NYR-Permit Number

Attn: Contact Name

Dear Mr. XXXX,

The Town of North Greenbush (Town) is a New York State Department of Environmental Conservation (NYSDEC) designated Municipal Separate Storm Sewer Systems (MS4) operator. As such, the Town is required to implement a Stormwater Management Program, which includes performing Stormwater Pollution Prevention Plan (SWPPP) construction activity oversight and enforcing the NYSDEC State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges Associated with Construction Activities regulations.

In compliance with these regulations, the Town reviewed your construction site activities, record keeping, and the implementation of your SWPPP for the above referenced project site on XXXX XX, 2021. Based upon the attached Compliance Inspection Report, your site was found to be **un-satisfactory** with regards to implementing the project SWPPP. You are directed to cease earthwork activity except for corrective action and to:

- Review your project SWPPP with your Qualified Inspector;
- Implement Best Management Practices to effectively comply with your SWPPP;
- Review the Construction General Permit Requirements; and
- Implement the corrective actions indicated in the attached Compliance Inspection Report to comply with the SWPPP within one day of receipt of this letter and to complete these actions in a reasonable time.

If you are unable to implement corrective actions within one day of the receipt of this letter, or cannot implement them in a manner consistent with the SWPPP, you must notify the Town, immediately and in writing, why this is so and propose an alternate remediation plan for addressing the deficiencies as well as a revised schedule for their implementation.

Please note that the Construction General Permit requires that the owner or operator, its contractors, subcontractors, agents and/or assigns who obtained coverage under the Permit certify that they have read or been advised of the Permit conditions, understand them, and agree to comply with all terms and conditions of the Permit. Failure to implement the corrective actions outlined in the Compliance Inspection Report may result in the following actions:

- Issuance of a Stop Work Order;



- Denial of Building Permit and Certificate of Occupancy Requests; and
- Assessment of fines, regulatory agency notification and/or further legal action.

Please contact the Town when the deficiencies outlined in the Compliance Inspection Report have been corrected so that they can be re-inspected for compliance. If you have any questions or comments or would like further clarification on the items discussed within this letter, please do not hesitate to call the Building Department.

Thank you for your cooperation and prompt attention in this matter.

Regards,



Mike Miner, Building Inspector



Town of North Greenbush

2 Douglas Street
Wynantskill, NY 12198
Office: (518) 283-2714
Cell: (518) 912-1568

OR



Eric Westfall, PE



Town of North Greenbush

2 Douglas Street
Wynantskill, NY 12198
Office: (518) 283-2714 x14
Cell: (518) 491-6824

Attachments: Compliance Inspection Report

Cc: File
Building Department
XXXXXXXXXX



Town of North Greenbush Stormwater Compliance Inspection Report

Project Information

Project Name: _____

Name & Address of SPDES Permittee: _____

On-site Representative: _____

Contractor Name: _____

Inspection Date: _____

Permit #: _____

Weather Conditions: _____

SPDES Authority

-Is a copy of the NOI Posted at the construction site for public viewing?	YES	NO	N/A
-Is an up-to-date copy of the signed SWPPP retained at the construction site:	YES	NO	N/A
-Is a copy of the SPDES General Permit retained at the construction site?	YES	NO	N/A

SWPPP Content

-Does the SWPPP describe and identify erosion and sediment control measures to be employed?	YES	NO	N/A
-Does the SWPPP provide a maintenance schedule for the erosion and sediment control?	YES	NO	N/A
-Does the SWPPP identify the contractor(s) and subcontractor(s) responsible for each measure?	YES	NO	N/A
-Does the SWPPP include all the necessary öCONTRACTOR CERTIFICATIONö statements?	YES	NO	N/A



Is the SWPPP signed/Certified by the Permittee? YES NO N/A

Recordkeeping

-Are the inspections performed as required by the permit (every 7 days and after ½" rain event)? YES NO N/A

-Are inspections performed by a qualified professional? YES NO N/A
 Name: _____

Are all required reports properly signed/certified? YES NO N/A

Visual Observations

-Are all erosion and sediment control measures installed/constructed? YES NO N/A

-Are all erosion and sediment control measures maintained properly? YES NO N/A

-Have all disturbances of 5 acres or more been approved prior to disturbance? YES NO N/A

-Are stabilization measures initiated in active areas? YES NO N/A

-Are permanent stormwater control measures implemented? YES NO N/A

-Evidence of turbidity, sedimentation or oil found offsite? YES NO N/A

-Was there a discharge into the receiving water on the day of the inspection? YES NO N/A

Water Quality Observations (Use Photo/Notes Section to Elaborate)

-Describe the discharge(s) [source(s), impact on Receiving water(s), etc] YES NO N/A

-Describe the quality of the receiving water(s) both upstream and downstream of the discharge YES NO N/A

-Describe any other water quality standards or Violations YES NO N/A

Water Quality Violations Notes YES NO N/A

Notes

Noted Deficiencies and Corrective Actions Summary

Noted Deficiency	Required Corrective Action

Photographs

Attach all reference photographs to the end of this report

Summary/Remarks

Overall Inspection Rating: _____

Name of Inspector: _____

Inspector's Signature: _____

Contractor's Acknowledgment: _____



Exhibit 23

SWPPP Post-Construction Inspection and Project Closure Policy

When construction activities associated with the SWPPP have been completed, the contractor may request a Notice of Termination (NOT) to end coverage of under the environmental permit. It should be noted that the Town generally does **not** accept NOT requests between November and March due to the fact that permanent soil stabilization measures have often not had a chance to take hold and become stable. This is a general guideline, however, and not a strict policy, and it is acceptable for the Town to honor NOT requests during those months based upon the specifics of a particular construction site. The Town's procedure for issuing a signed NOT is as follows:

- The permittee's qualified professional will conduct a Self-Inspection of the project site for compliance with the SWPPP and the permittee will send a copy of the SWPPP NOT form to the Town's Stormwater Management Officer for signature. All other fields in the NOT form are to be complete prior to submitting the NOT document to the Town.
- The Town will conduct a Comprehensive Inspection of the project site, following the same general on-site inspection procedures outlined in Exhibit 22, paying particular attention to the following items:
 - Construction debris and trash have been removed.
 - Temporary BMPs have been removed.
 - Disturbed surfaces have been stabilized, with no signs of erosion, and that stabilizing measures are firmly in place and vegetated areas are at least 80% established (reseeding or the installation of additional vegetation or mulch may be required).
 - Post-construction BMPs are in place and operational (verified with SWPPP).
 - Drainage inlets are installed correctly, stabilized, operational, and clear of debris.
 - Banks, ditch bottoms, and drainage conveyances are stabilized and vegetation is established.
 - Drainage outlets are installed correctly, stabilized, operational, and clear of debris.
 - Areas where runoff flows may converge or high-velocity flows are expected are stabilized.
- The Town Stormwater Management Officer will sign the NOT form and return to the Owner/Operator for submission to the permit issuer.
- The Owner/Operator will notify the Town when the NOT form has been submitted and when permit coverage has been terminated.
- In instances where an NOT is required to transfer operational control to another party, the existing permit holder and the potential new permit recipient will meet with the Town Stormwater Management Officer to discuss this transition.
- The Town will keep copies of the SWPPP, site Comprehensive Inspections, and other critical stormwater management documents related to a project for at least three years from the date of the NOT.

A copy of a blank NOT form is included with this Exhibit

**New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505
*(NOTE: Submit completed form to address above)***

**NOTICE OF TERMINATION for Storm Water Discharges Authorized
under the SPDES General Permit for Construction Activity**

Please indicate your permit identification number: NYR _____

I. Owner or Operator Information

1. Owner/Operator Name:

2. Street Address:

3. City/State/Zip:

4. Contact Person:

4a. Telephone:

4b. Contact Person E-Mail:

II. Project Site Information

5. Project/Site Name:

6. Street Address:

7. City/Zip:

8. County:

III. Reason for Termination

9a. All disturbed areas have achieved final stabilization in accordance with the general permit and SWPPP. ***Date final stabilization completed** (month/year): _____

9b. Permit coverage has been transferred to new owner/operator. Indicate new owner/operator's permit identification number: NYR _____
(Note: Permit coverage can not be terminated by owner identified in I.1. above until new owner/operator obtains coverage under the general permit)

9c. Other (Explain on Page 2)

IV. Final Site Information:

10a. Did this construction activity require the development of a SWPPP that includes post-construction stormwater management practices? yes no (If no, go to question 10f.)

10b. Have all post-construction stormwater management practices included in the final SWPPP been constructed? yes no (If no, explain on Page 2)

10c. Identify the entity responsible for long-term operation and maintenance of practice(s)?

**NOTICE OF TERMINATION for Storm Water Discharges Authorized under the
SPDES General Permit for Construction Activity - continued**

10d. Has the entity responsible for long-term operation and maintenance been given a copy of the operation and maintenance plan required by the general permit? yes no

10e. Indicate the method used to ensure long-term operation and maintenance of the post-construction stormwater management practice(s):

- Post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain practice(s) have been deeded to the municipality.
- Executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s).
- For post-construction stormwater management practices that are privately owned, a mechanism is in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the owner or operator's deed of record.
- For post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university or hospital), government agency or authority, or public utility; policy and procedures are in place that ensures operation and maintenance of the practice(s) in accordance with the operation and maintenance plan.

10f. Provide the total area of impervious surface (i.e. roof, pavement, concrete, gravel, etc.) constructed within the disturbance area? _____
(acres)

11. Is this project subject to the requirements of a regulated, traditional land use control MS4? yes
 no
(If Yes, complete section VI - "MS4 Acceptance" statement

V. Additional Information/Explanation:
(Use this section to answer questions 9c. and 10b., if applicable)

VI. MS4 Acceptance - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative (Note: Not required when 9b. is checked -transfer of coverage)

I have determined that it is acceptable for the owner or operator of the construction project identified in question 5 to submit the Notice of Termination at this time.

Printed Name:

Title/Position:

Signature:

Date:

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the
SPDES General Permit for Construction Activity - continued

VII. Qualified Inspector Certification - Final Stabilization:

I hereby certify that all disturbed areas have achieved final stabilization as defined in the current version of the general permit, and that all temporary, structural erosion and sediment control measures have been removed. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:

Title/Position:

Signature:

Date:

VIII. Qualified Inspector Certification - Post-construction Stormwater Management Practice(s):

I hereby certify that all post-construction stormwater management practices have been constructed in conformance with the SWPPP. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:

Title/Position:

Signature:

Date:

IX. Owner or Operator Certification

I hereby certify that this document was prepared by me or under my direction or supervision. My determination, based upon my inquiry of the person(s) who managed the construction activity, or those persons directly responsible for gathering the information, is that the information provided in this document is true, accurate and complete. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:

Title/Position:

Signature:

Date:

Exhibit 24

Stormwater Permit Tracking Spreadsheet

The Town tracks New York State Department of Environmental (DEC) permits issued for construction projects requiring coverage. The attached tracking spreadsheet records the following information:

DEC

- Submission Date
- Permit ID Number
- Permit Status
- Permit Facility Name
- Permit Address

Applicant

- Name
- Address
- Contact Number

Town of North Greenbush

- Comprehensive Inspection Dates
- Action and Priority
- Construction and Permitting Status

The Town receives an e-mail from DEC when a Notice of Intent has been filed and a Permit Number generated, and also uses the following DEC website to populate its Permit Tracking Spreadsheet:

<ftp://ftp.dec.state.ny.us/dow/stormdocuments/Construction%20NOI%20Spreadsheets/>

Town of North Greenbush Stormwater Management Project Spreadsheet
Revised 6/1/2021

NYSDEC					Applicant/Developer			Town of North Greenbush					
Database Information					Owner/Operator Information			Comprehensive Inspection				Management	
Latest Submission Date	Program ID	Terminated	Facility Name	Address 1	Name	Address	Contacts (Phone/e-mail)	Inspector	Frequency	Date	Action Req'd?	Priority	Status/Notes
09/13/2019	NYR11F667	No	Bloomingrove Terrace	194 Bloomingrove Drive	Bloomingrove Development, LLC	2 Geneva Blvd, Wynantskill, NY 12198	Eric Kohler 518-376-487	Mike Miner	30 Days	05/28/21	No	Medium	Work in Progress, site stable, permanent stormwater control measures in place
2/3/2011	NYR10T654	No	BIRCHWOOD HILLS	WINTER STREET EXTENSION AT NORTH ROAD	Hodorowski Homes	796 Burdeck St, Schenectady, NY 12306	Paul Hodorowski 518-470-5281	Mike Miner	30 Days	05/28/21	Yes	Medium	Inactive and substantially stabilized with minor areas that are being addressed this Spring. NOT Pending
3/18/2015	NYR10Z141	No	PDD DEVELOPMENT	ROUTE 4 & GLENMORE ROAD	Hudson Valley Stargreens, LLC	1 Coyote Lane, Troy NY 12180	Mark Van Vleck 518-857-2017	Laberge Group	30 Days	05/27/21	Yes	High	Work in progress and remediation in progress
5/1/2019	NYR11F099	No	Dagen Residence	U.S. Route 43	Jeff Dagen	55 Empire Blvd, Castleton on Hudson, NY 12033	518-496-2581	Mike Miner	30 Days	05/28/21	No	Medium	Work Complete. NOT Requested.
5/8/2018	NYR11D636	No	HAYWOOD LANE SUBDIVISION	SNYDERS LAKE ROAD	Hodorowski Homes	796 Burdeck St. Schenectady NY 12306	Paul Hodorowski 518-470-5281	Mike Miner	30 Days	05/28/21	No	Medium	Inactive and substantially stabilized with minor areas that will be addressed when construction begins again
3/1/2019	NYR11D808	No	THE MEADOWS	ROUTE 4	RA Momentum	1 Madison Ave, Troy NY	Anthony Casale 518-283-0834	Laberge Group	30 Days	05/27/21	Yes	High	Work in progress and remediation in progress. Seeking updated area of disturbance.
11/7/2018	NYR11E450	No	FILL & GRADING SITE	NORTH GREENBUSH ROAD	David Mulinio	DF Acquisitions III, 1 Coyote Lane, Troy NY 12180	518-857-1374	Mike Miner	30 Days	05/28/21	No	Low	Work Complete, transitioned to site NYR11H016, 20,000 SF commercial development
11/10/20	NYR11H400	No	Little Red Schoolhouse Addition	49 North Greenbush Road	North Greenbush Commons	49 North Greenbush Road	518-283-6748	Mike Miner	30 Days	05/28/21	No	Low	Work in progress
09/16/20	NYR11H171	No	US Rte 4 Intersection and Pedestrian Improvements	US Rte 4	Brian Turton - Rifenberg	159 Brick Curch Road, Troy, NY 12180	518-728-4313	Mike Miner	30 Days	05/28/21	No	Low	Work in progress
08/13/20	NYR11H016	No	20,000 sf Commercial Development	North Greenbush Road	David Mulinio	DF Acquisitions III, 1 Coyote Lane, Troy NY 12180	518-857-1374	Mike Miner	30 Days	05/28/21	No	Medium	Work in progress
03/13/2020	NYR11G387	No	Greenbush Estates	North Road & Buckbee Road	North Greenbush Builders, LLC	Wynantskill, NY	Mark Van Vleck 518-857-2017	Mike Miner	30 Days	05/28/21	Yes	Medium	Work in progress, additional stormwater control measures required
04/19/2021	NYR11i025	No	Hidley Estates	Hidley Road	North Greenbush Builders, LLC	Wynantskill, NY	Dave Mulinio 518-857-1374	Mike Miner	30 Days	05/28/21	No	High	Work in progress
10/23/2009	NYR10R856	No	TECH VALLEY PLAZA	NYS ROUTE 4	BT Albany	200 Dryden RD, Suite 200, Dresher, PA 19025	Paul Goldman 518-431-0941	Mike Miner	30 Days	05/28/21	No	Low	Site partially active for staging and fill placement
11/16/2020	NYR11H410	No	Sharpe Road Subdivision	Sharpe Road	Sharp Road Development, LLC	Troy, NY	Dave Mulinio 518-857-1374						Work Pending
1/5/2017	NYR11B631	No	MIXED USE OFFICE & RETAIL BUILDING	16 NORTH GREENBUSH ROAD	David Mulinio	DF Acquisitions III, 1 Coyote Lane, Troy NY 12180	518-857-1374					Low	NOT signed by Town Engineer
8/26/2004	NYR10H643	No	Lake Meadows Subdivision	Geiser Road	Coldwell BankerPrime Properties	621 Columbia Street, Cohoes, NY 12047	Ken Raymond 518-785-9000					Low	Not active. Site stabilized. New SWPPP required for lots 39, 42, & 43
3/8/2019	NYR11E834	Yes	Lots 39, 42 & 43 Lake Meadows	Kent Place	Al Gould	40 Fellows Road, Halfmoon, Ny 12065	781-888-2787					Low	Work suspended, violation notice issued, have met with builder and adjacent land owner seeking resolution
7/21/2009	NYR10R460	No	TREO EXPANSION RPI TECH PARK	125 DEFREEST DRIVE	Treos Solutions	125 Defreest DR	Paul Olund 518-371-7621					Low	Work complete and site stabilized. Town awaiting NOT request from Owner/Operator
7/12/2010	NYR10S820	No	CVS AND BURGER KING - QUACKENDERRY COMMO	NYS ROUTE 4 (NORTH GREENBUSH ROAD)	Quackenderry Commons LLC	1 Juniper DR, Delmar NY 12054	Ed Feinburg 518-371-7621					Low	Work complete and site stabilized. Town awaiting NOT request from Owner/Operator

Town of North Greenbush Stormwater Management Project Spreadsheet
Revised 6/1/2021

NYSDEC					Applicant/Developer			Town of North Greenbush					
Database Information					Owner/Operator Information			Comprehensive Inspection				Management	
Latest Submission Date	Program ID	Terminated	Facility Name	Address 1	Name	Address	Contacts (Phone/e-mail)	Inspector	Frequency	Date	Action Req'd?	Priority	Status/Notes
7/11/2018	NYR11D954	No	Regeneron 382 Car Parking Lot	2 Global View	Hart Engineering	1969 Ferndale RD Castleton NY 12033	Steve Hart 518-479-4014					Low	NOT signed by Town Engineer
3/14/2007	NYR10M430	No	Camp Scully	24 Camp Scully Way	Albany Catholic Diocese	40 North Main Ave, Albany NY 12203	Colin Stewart 518-391-8952					Low	Site stabilized and activity suspended
2/6/2007	NYR10M263	No	Aries Cove Residential Subdivision	Peck Road	Christine & Michael Miner	174 Pershing Ave Wynantskill, NY 12198	518-912-1568					Low	NOT signed by Town Engineer and filed with DEC. Subdivision has been voided and restored to one original 37-acre parcel. Original owner can not be reached for NOT (deceased). New owner will be filing new SWPPP for project shortly. New Permit number to be assigned for project after filing
2/4/2010	NYR10S163	No	QUACKENDERRY COMMONS APARTMENTS	WASHINGTON AVENUE EXTENSION	Amedore Land Development	1900 Western Ave Albany NY 12203	John Bossalini 518-857-2951					Low	NOT signed by Town Engineer
12/24/2012	NYR10W234	Yes	RTP WETLAND IMPACT & MITIGATION PROJECT	JORDAN ROAD	RPI Technology Park	100 Defreest Drive, Troy NY 12180	Karl Lampson 518-755-7667					Low	Inactive, stabilized and awaiting status update
02/6/2020	NYR11G268	No	Noel 4 Lot Minor Subdivision	Mammoth Spring Road	TW Contracting	Geiser Road	518-365-3084					Low	Work Complete. NOT Requested.
11/2/2010	NYR10T344	No	CVS PHARMACY FOR QUACKENDERRY COMMONS PD	NYS ROUTE 4 (NORTH GREENBUSH ROAD)	Quackenderry Commons LLC	1 Juniper DR, Delmar NY 12054	Ed Feinburg 518-371-7621					Low	Work complete and site stabilized. Town awaiting NOT request from Owner/Operator
11/16/2009	NYR10R935	No	STRUCTURE REMOVAL AND REGRADING	NYS ROUTE 4 (NORTH GREENBUSH ROAD)	Quackenderry Commons LLC	1 Juniper DR, Delmar NY 12054	Ed Feinburg 518-371-7621					Low	Work complete and site stabilized. Town awaiting NOT request from Owner/Operator
10/10/2016	NYR11B376	No	WHITEVIEW ROAD SITE CLEARING	NYS RTE 136 (WHITEVIEW ROAD)	One Dodge ST Assoc.	Wynantskill, NY 12198	John Panichi 518-283-8500					Low	Site stabilized and activity suspended
1/28/2015	NYR10Y945	No	HOSPITALITY SYRACUSE, INC. - TACO BELL	563 NORTH GREENBUSH ROAD	Hospitality Syracuse, INC	290 Elwood Davis Rd Liverpool, NY 13088	Rob Osterhuodt 518-573-8071					Low	Work complete and site stabilized. Town awaiting NOT request from Owner/Operator
1/19/2017	NYR11B676	No	COLE'S COLLISION	97 NORTH GREENBUSH ROAD (US ROUTE 4)	Cole's Collision Center	1517 Central Ave, Albany, NY 12205	Luigi Palleschi 518-377-0315					Low	NOT signed by Town Engineer
8/30/2006	NYR10L549	Yes	NYISO Headquarters	10 Krey Boulevard	Creighton Manning Engineering	17 Computer Drive West, Albany NY 12211	518-446-0396						NOT signed by Town Engineer
9/14/2018	NYR11E243	Yes	DUNN FIELD GRADING PROJECT	PARTITION STREET EXT.	Kubricky Construction Corp	269 Ballard Road, Wilton NY 12831	Olin Ellsworth 518-791-2051						NOT signed by Town Engineer
7/18/2007	NYR10N224	Yes	Van Rensselaer Square	US RT 4 at NYS RT 43	BT Albany	200 Dryden RD, Suite 200, Dresher, PA 19025	Paul Goldman 518-431-0941						NOT signed by Town Engineer
10/17/2019	NYR11F855	Yes	Enzien Car Wash	531 North Greenbush Road	Enzien Inc.,	167 Lape Rd, Renssealer, NY 12144	518-469-8362						NOT signed by Town Engineer
10/18/2007	NYR10N713	Yes	Jordan Point	Jordan Road	Hodorowski Homes	796 Burdeck St, Schenectady, NY 12306	Paul Hodorowski 518-470-5281						NOT signed by Town Engineer

Exhibit 25

Post-Construction Stormwater Management Practices Inventory

Permanent Stormwater Management Practices (Practices) are an integral part of controlling and managing stormwater once construction is complete. In order to facilitate the Post-Construction Stormwater Management Practices Inspection and Enforcement Program outlined in Exhibit 26, the Town has developed a spreadsheet and mapping system to track and monitor inspections and corrective actions for various public and private Practices throughout the Town.

The current tracking system for Practices within the Town involves the following:

- Assigning the Practice an Identification Number and Name on the tracking spreadsheet.
- Showing the Practice graphically on the Town's Stormwater Practices Map, which is a Geographic Information System (GIS) Street Map available from Rensselaer County with the Practice number overlaid on the map.
- Tracking the Inspection Date and any Actions or Comments on the tracking spreadsheet.

The Town is conducting an audit of its Practices during 2021 to address the following:

- Verifying that all Practices within the Town are accounted for on the Stormwater Practices Map and entered in the Practices Inventory Spreadsheet.
- Implementing a more stringent Notification and Enforcement policy, in accordance with Exhibit 25, for Practices that have fallen into disrepair or are not routinely or properly maintained.

The Town is currently investigating the implementation of GIS Mapping for stormwater measures, utilities, natural resources, and other elements within the Town, and hopes to update its mapping system and procedures generally within the next two years.

Copies of the current Post-Construction Stormwater Management Practices Inventory spreadsheet and Stormwater Practices Maps are included with the Exhibit.

Town of North Greenbush

Post-Construction Stormwater Management Practices Inventory

Updated 06/01/21 - EPW

ID No.	Name/Location	Latitude and Longitude	Map Sector	Year Constr.	Maintained By	Latest Inspection	Type of Practice	Routine Required Maintenance	Routine Maintenance Performed	Additional Comments or Non-Routine Maintenance
1A	Haywood Lane West	42-39-48 / 73-41-08	D3	2001	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
1B	Haywood Lane East	42-39-48/73-41-01	D3	2001	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
2	Birch Court	42-41-10/73-40-21	E5	2001	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
3	Crown Point	42-40-38/73-41-16	D5	2006	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
4	Taco Bell	42-38-58/73-41-45	C2	2019	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
5	Montessori School	42-38-44/73-41-42	C2	2012	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
6	125 Defreest - RPI	42-40-33/73-41-33	C4	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
7	Forest Hills	42-38-51/73-40-08	E2	2008	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
8	GE	42-40-24/73-42-02	C4	2008	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
9	Hampton Place	42-41-29/73-40-48	D6	1989	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
10	Hannaford	42-41-48/73-39-01	F6	1989	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
11	Jordan Point	42-40-24/73-41-12	D4	2011	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
12A	Lake Meadows North	42-39-40/73-38-31	G3	1993	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		

Town of North Greenbush

Post-Construction Stormwater Management Practices Inventory

Updated 06/01/21 - EPW

ID No.	Name/Location	Latitude and Longitude	Map Sector	Year Constr.	Maintained By	Latest Inspection	Type of Practice	Routine Required Maintenance	Routine Maintenance Performed	Additional Comments or Non-Routine Maintenance
12B	Lake Meadows South	42-39-25/73-38-39	G3	1993	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
13	Clemente Latham	42-41-00/73-36-54	H5	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
14A	Oak Hills North	42-39-31/73-41-50	C3	2005	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
14B	Oak Hills South	42-39-27/73-41-43	C3	2005	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
15A	Van Rensselaer Sq North	42-39-27/73-41-29	D3	2007	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
15B	Van Rensselaer Sq West	42-39-18/73-41-35	D3	2007	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
15C	Van Rensselaer Sq South	42-39-12/73-41-24	D2	2007	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
16	West Ave	42-41-27/73-39-29	F6	2001	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
17	Woodberry Hills	42-41-54/73-37-12	H6	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
18	Seasons	42-41-06/73-37-43	H5	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
19A	Crimson Circle North	42-41-14/73-40-19	E6	2008	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
19B	Crimson Circle West	42-41-13/73-40-06	E5	2008	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
20	CVS Main Avenue	42-41-45/73-38-44	G6	1997	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		

Town of North Greenbush

Post-Construction Stormwater Management Practices Inventory

Updated 06/01/21 - EPW

ID No.	Name/Location	Latitude and Longitude	Map Sector	Year Constr.	Maintained By	Latest Inspection	Type of Practice	Routine Required Maintenance	Routine Maintenance Performed	Additional Comments or Non-Routine Maintenance
21	Cap Com	42-39-12/73-41-24	D2	2008	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
22	Coles Colision	42-41-27/73-41-11	D6	2019	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
23	Summit at Eastwyck	42-39-01/73-41-23	D2	2010	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
24A	The Pastures West	42-41-25/73-40-06	E6	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
24B	The Pastures Central	42-41-24/73-40-05	E6	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
24C	The Pastures East	42-41-18/73-39-50	E5	2009	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
25	Northeastern Lumber	42-38-50/73-41-49	C2	1996	Private	4/30/2021	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth	Perimeter mowing, removal of trash, removal of unwanted growth	No action required at this time
26A	The Villages of NG West	42-41-36/73-41-30	D6	2019	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
26B	The Villages of NG East	42-41-34/73-41-20	D6	2019	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
27	Rt 4 Car Wash	42-39-03/73-41-42	C2	2020	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
28	Bloomingrove Terrace	42-41-04/73-41-00	D5	2020	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
29A	The Meadows East	42-41-12/73-41-24	D5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
29B	The Meadows Anthony	42-41-12/73-41-24	D5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		

Town of North Greenbush

Post-Construction Stormwater Management Practices Inventory

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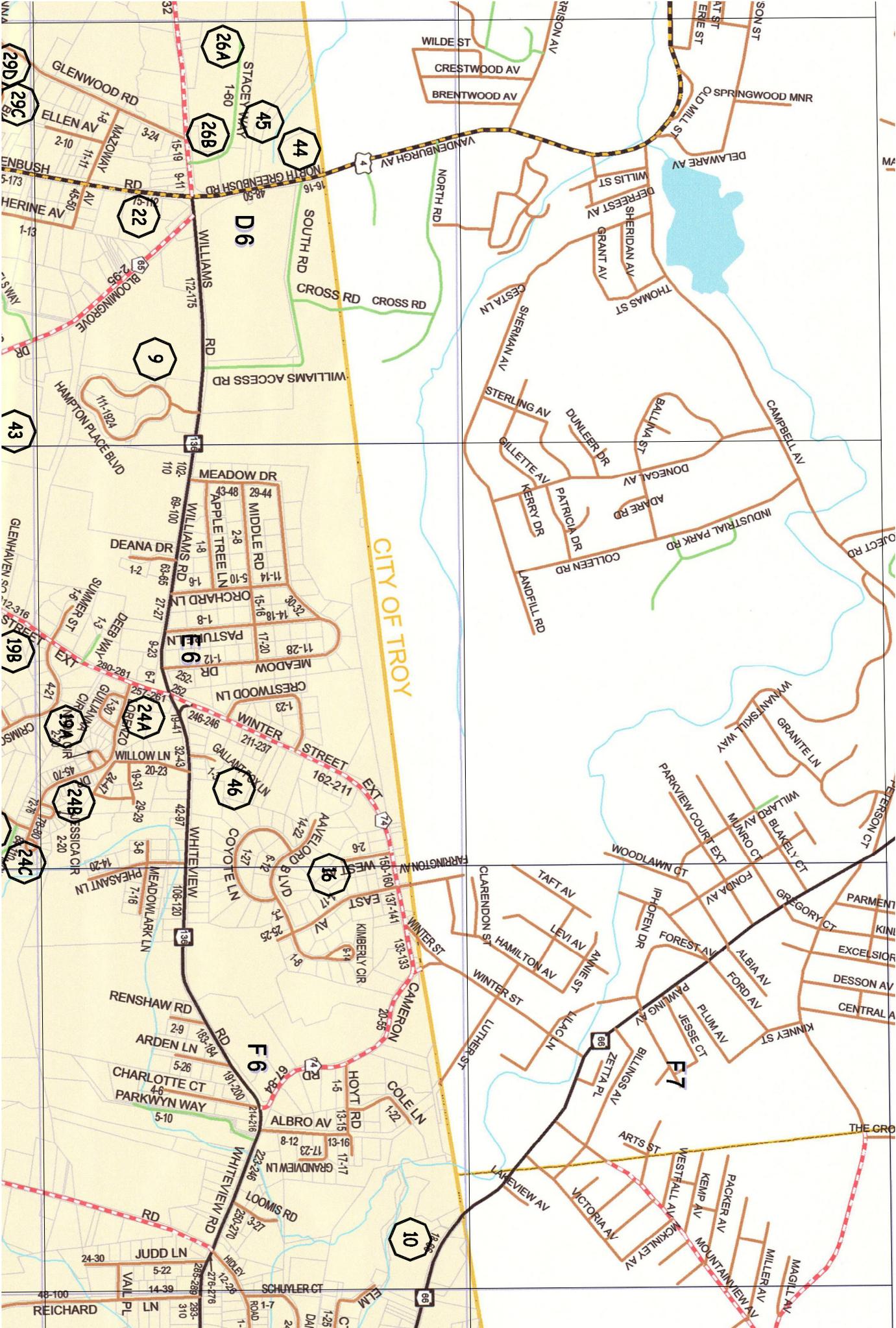
ID No.	Name/Location	Latitude and Longitude	Map Sector	Year Constr.	Maintained By	Latest Inspection	Type of Practice	Routine Required Maintenance	Routine Maintenance Performed	Additional Comments or Non-Routine Maintenance
29C	The Meadows Brianna	42-41-14/73-41-25	D5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
29D	The Meadows Glenwood	42-41-14/73-41-30	D5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
29E	The Meadows Pump	42-41-13/73-41-31	D5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
29F	The Meadows Giovanna West	42-41-11/73-41-36	C5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
29G	The Meadows Giovanna East	42-41-13/73-41-33	C5	2020	Private	2020	Bioretention Area	Perimeter mowing, removal of trash, removal of unwanted growth		
30	Tech Valley Plaza	42-39-13/73-41-37	D2	Pending	Pending	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
31A	Swiss Acres West	42-40-15/73-40-31	E4	1983	Town	4/30/2021	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth	Perimeter mowing, removal of trash, removal of unwanted growth	No action required at this time
31B	Swiss Acres East	42-40-14/73-40-20	E4	1983	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
32	Comm Resource Credit	42-39-15/73-41-43	C2	2016	Private	4/30/2021	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth	Perimeter moving, removal of trash	Some weed growth noticed
33	Home Depot	42-38-56/73-42-05	C2	2002	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
34	Stone Gate	42-39-46/73-41-58	C3	2012	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
35A	Van Allen Apartments West	42-39-03/73-42-23	C2	2016	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
35B	Van Allen Apartments East	42-39-02/73-42-11	C2	2016	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		

Town of North Greenbush

Post-Construction Stormwater Management Practices Inventory

Updated 06/01/21 - EPW

ID No.	Name/Location	Latitude and Longitude	Map Sector	Year Constr.	Maintained By	Latest Inspection	Type of Practice	Routine Required Maintenance	Routine Maintenance Performed	Additional Comments or Non-Routine Maintenance
36	Birchwood Hills Drive	42-41-11/73-39-54	E5	2019	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
37	Church Street	42-41-59/73-37-52	H6	N/A	N/A	None	Stormwater Pond			Requires verification
38	Lake Meadows	42-39-40/73-38-31	N/A	1993	Town	2020	Stormwater Pond			Replicate of #12 - Verify
39	Well Now	42-38-56/73-41-47	C2	2020	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
40	Parker School	42-39-16/73-39-08	F2	2005	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
41A	Pond Hill West	42-40-07/73-39-34	F4	1989	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
41B	Pond Hill East	42-40-05/73-39-25	F4	1989	Town	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
42	Vanderheyden Hall	42-41-24/73-36-53	I6	1999	County	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
43	VanRensselaer Manor	42-41-19/73-40-49	D5	1995	County	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
44	16 North Panera	42-41-40/73-41-18	D6	2019	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
45	28 North	42-41-38/73-41-20	D6	Pending	Private	2020	Stormwater Pond	Perimeter mowing, removal of trash, removal of unwanted growth		
46	Gallant Fox	42-41-32/73-40-01	E6	N/A	N/A	None	Stormwater Pond	Stormwater management area no longer exists		Removed



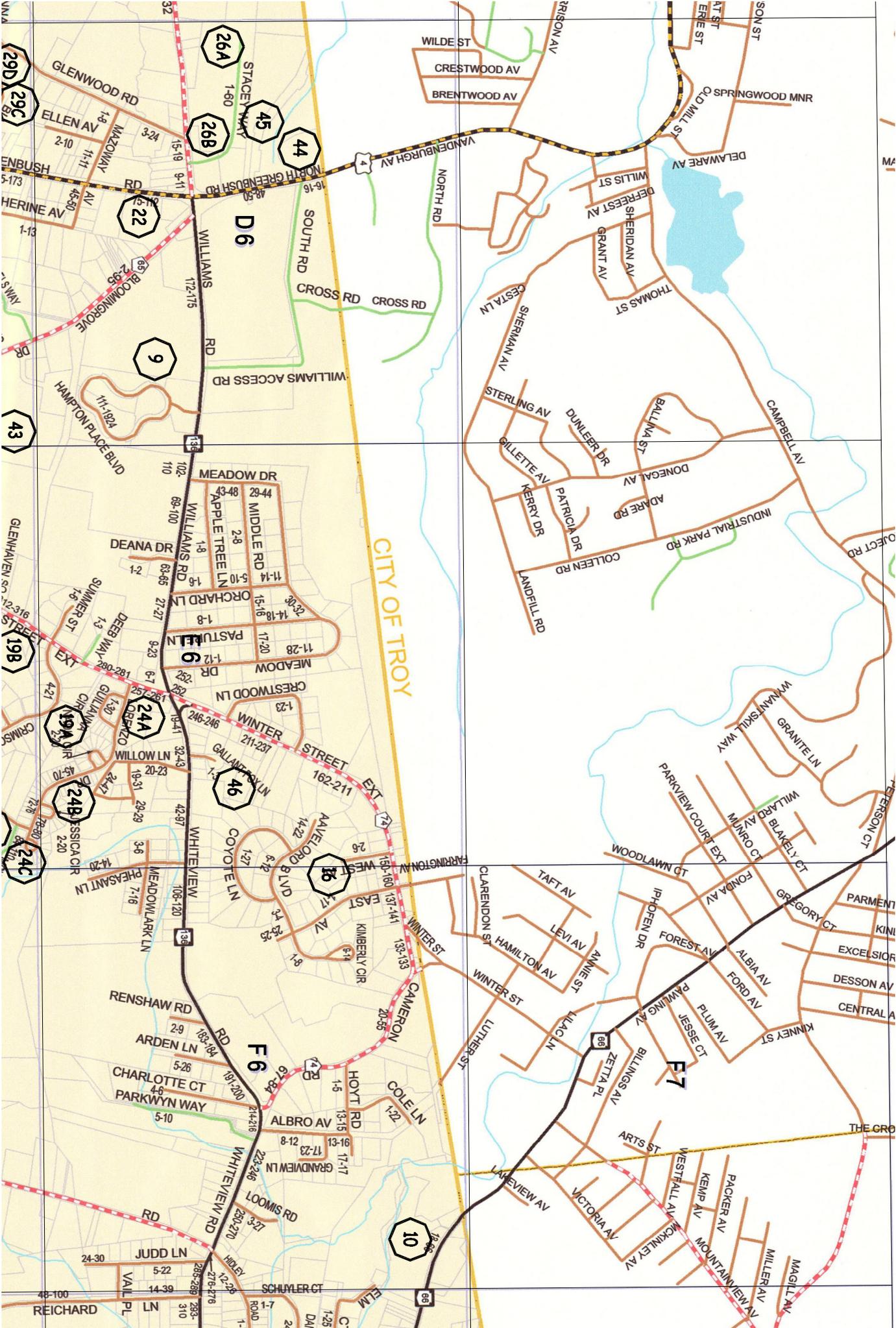
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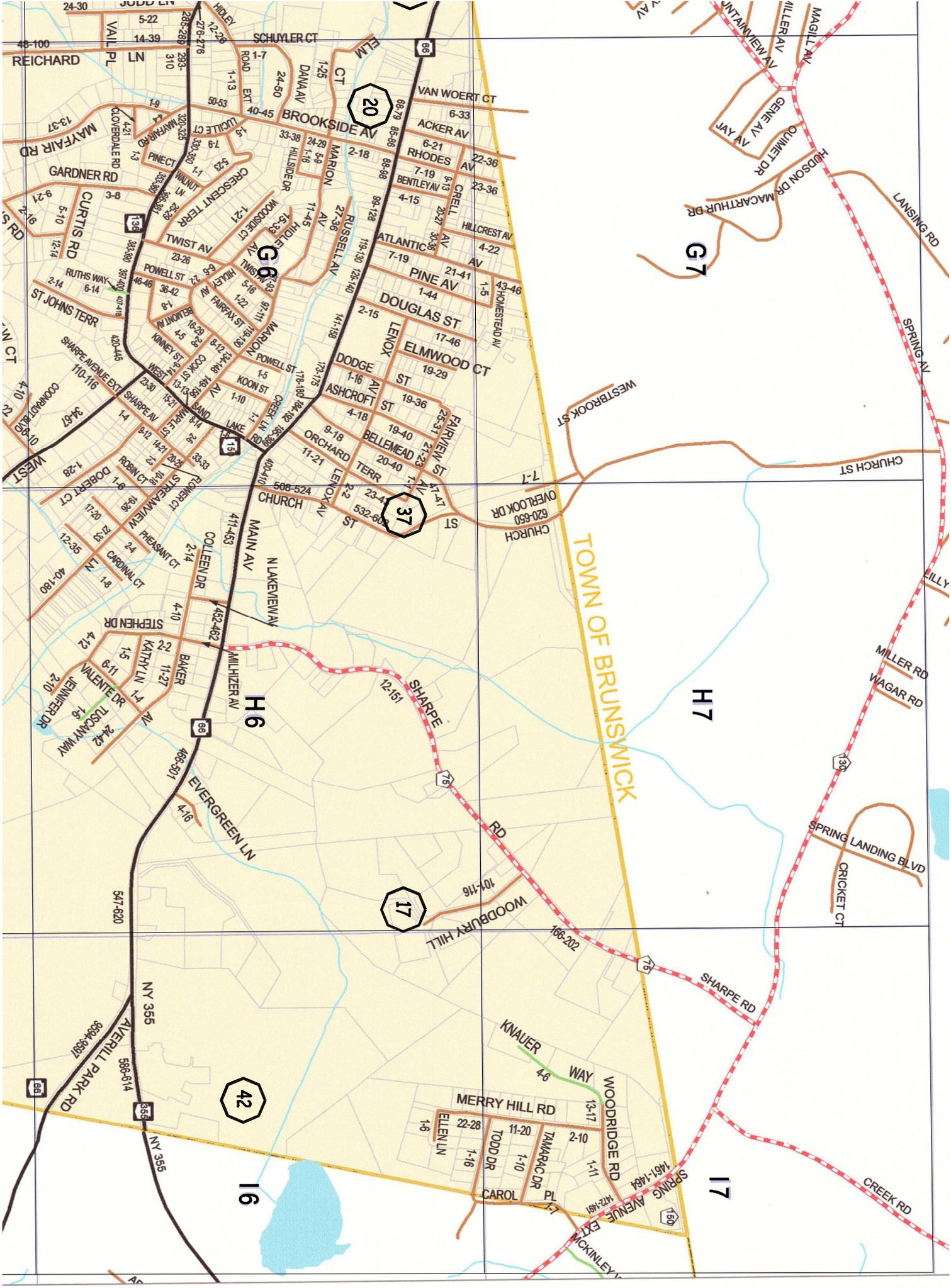
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CRICKET CT

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MILLER RD
WAGAR RD

CHURCH ST

CHURCH
OVERLOOK DR

WESTBROOK ST

WOODBURY HILL
RD

KNAUER
WAY

MERRY HILL RD

TODD DR

CAROL PL

ELLEN LN

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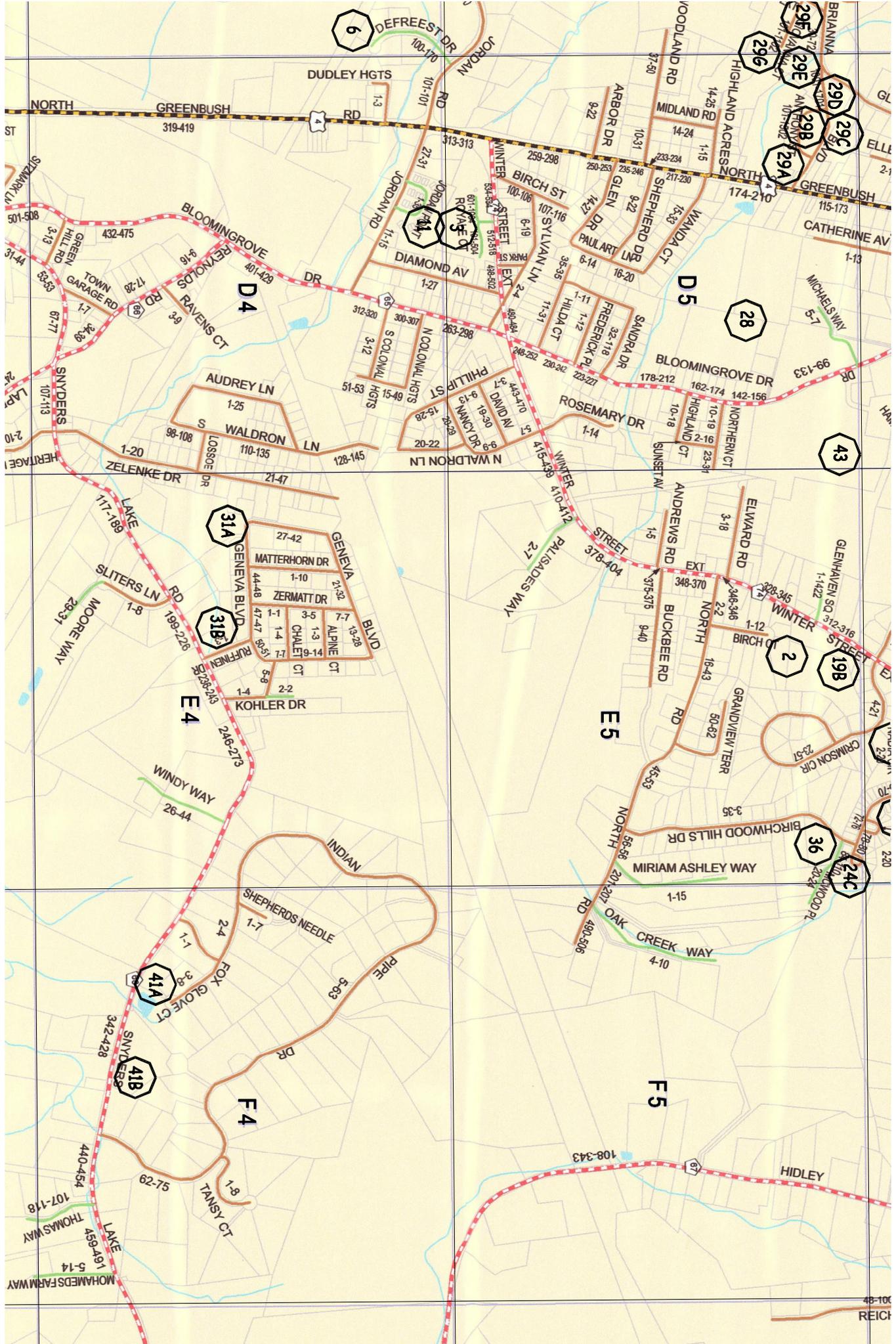
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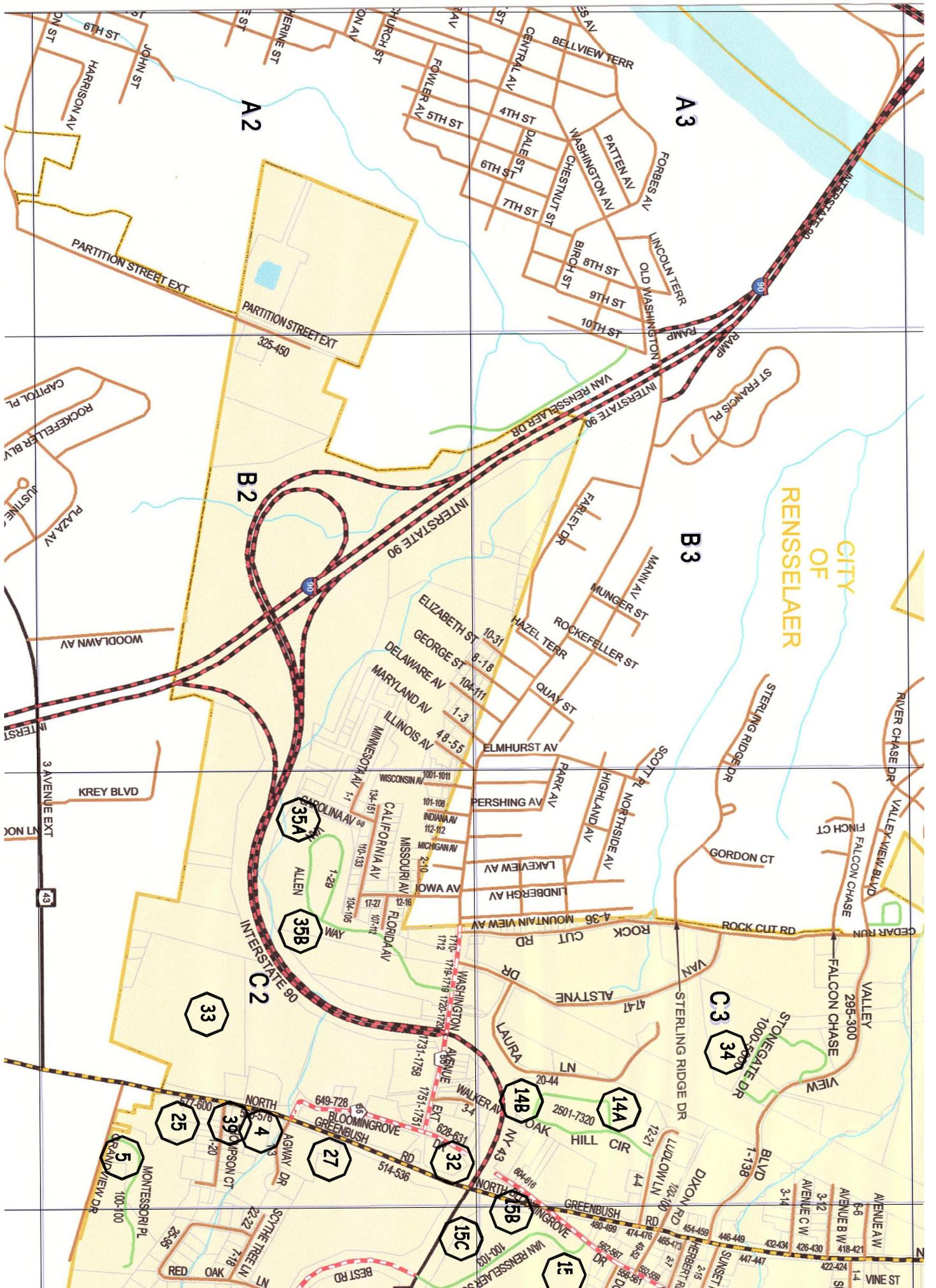
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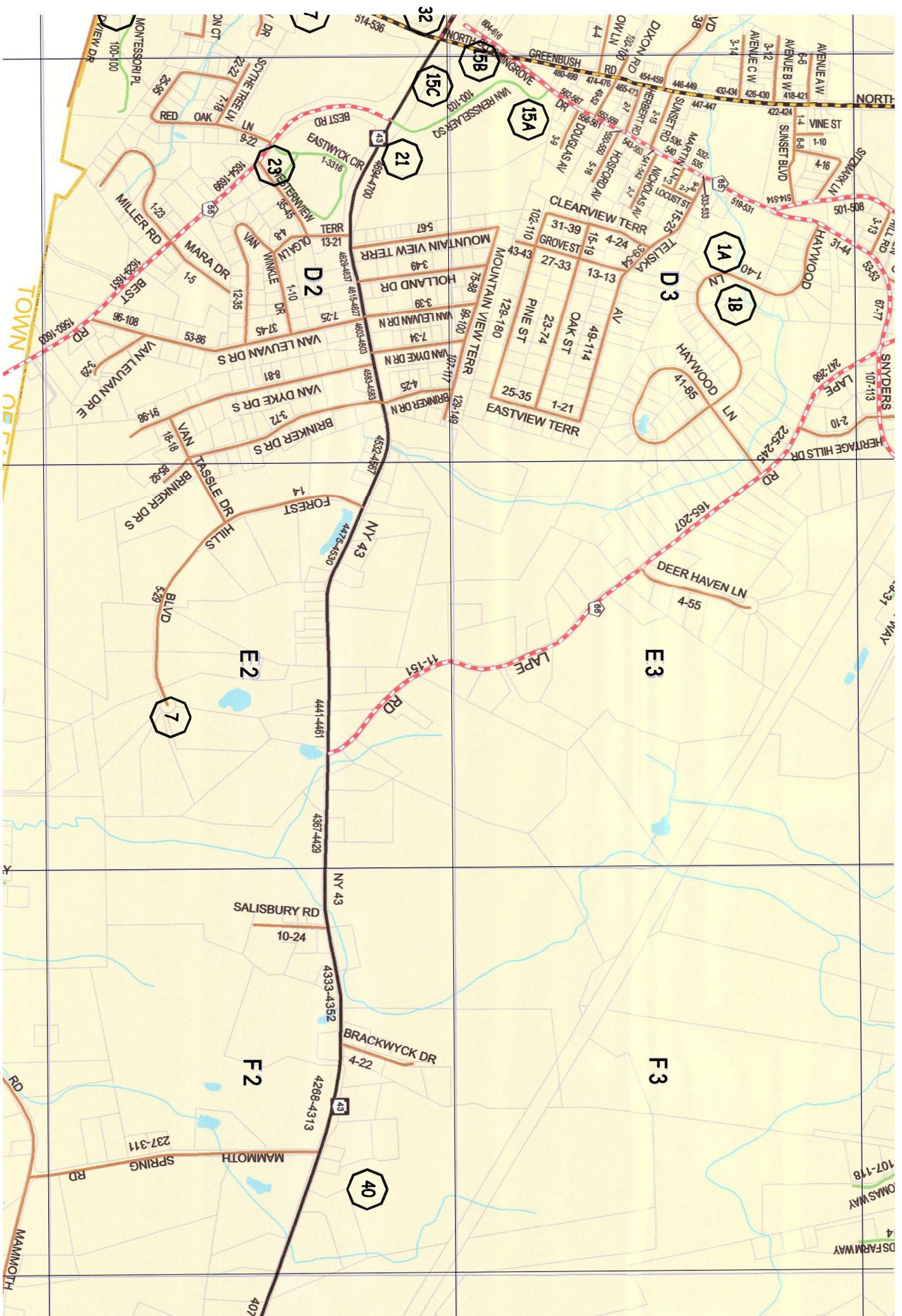
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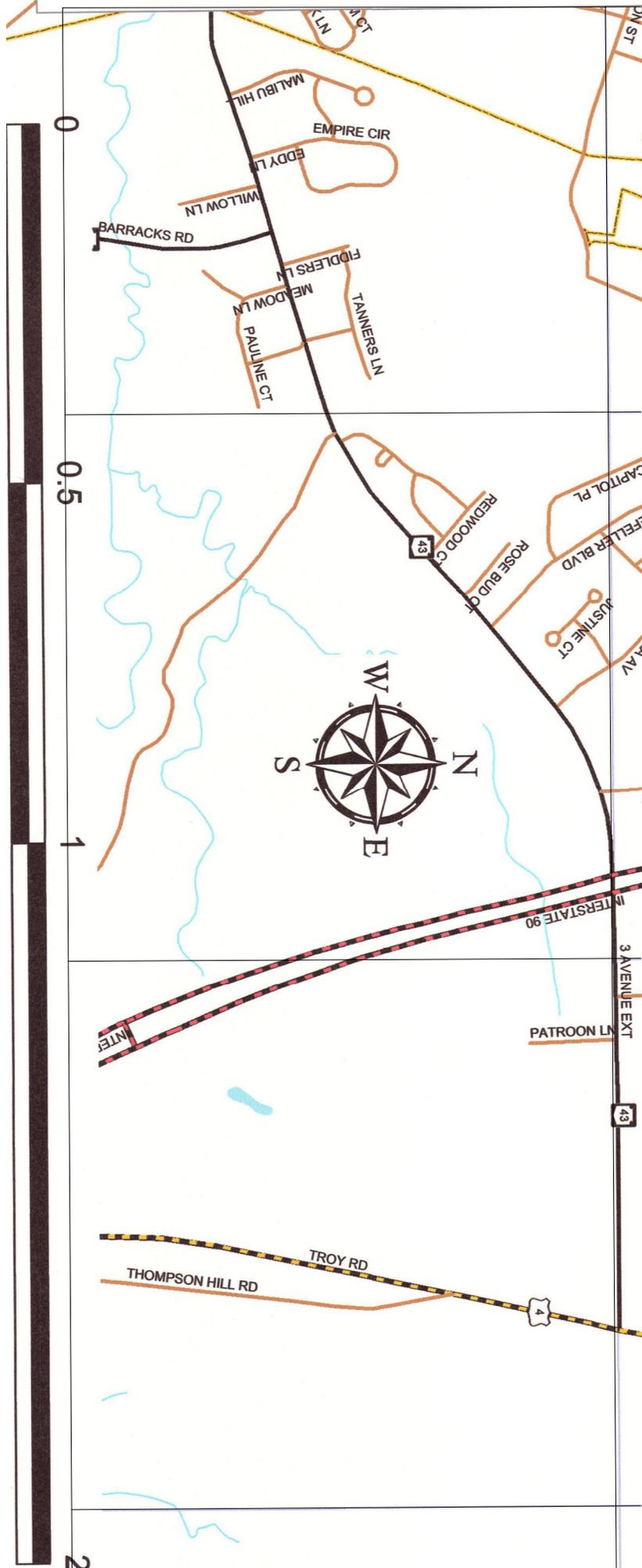
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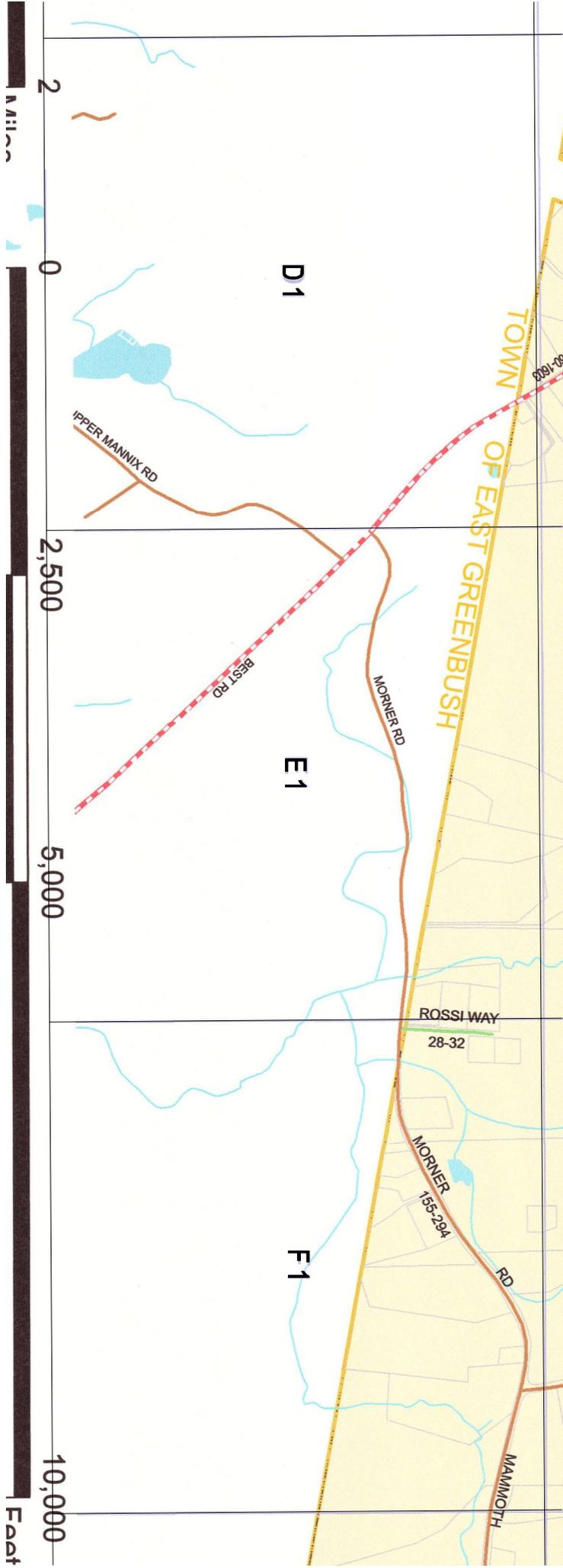
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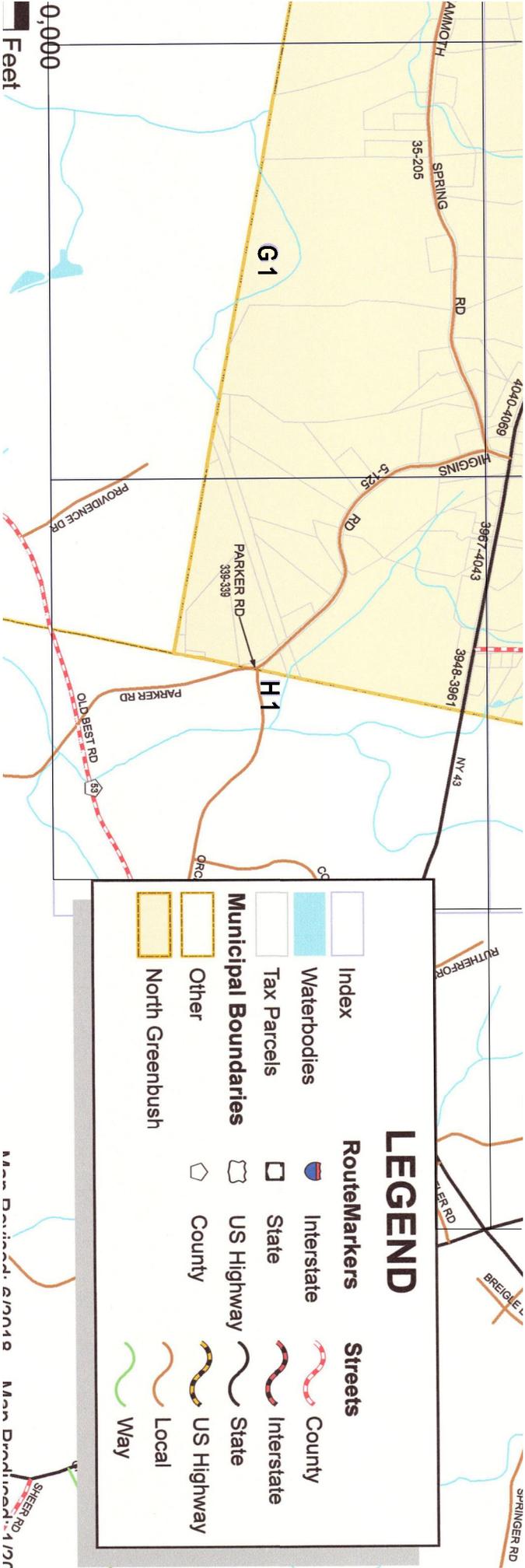
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LEGEND

Index	Interstate	County
Waterbodies	State	Interstate
Tax Parcels	US Highway	State
Municipal Boundaries	County	US Highway
Other		Local
North Greenbush		Way

Map Date: 02/2019 Map Drawn: 01/2010

Exhibit 26

Post-Construction Stormwater Management Practices Inspection and Enforcement

Following construction, it is important for permanent Stormwater Management Practices (Practices) to be regularly inspected and maintained so that they continue to function as designed. As such, the Town has developed a Post-Construction Stormwater Management Practices Inventory spreadsheet and map, included in the SWMP as Exhibit 25.

Inspection Policy

Each of the Practices, whether publicly or privately owned, shall be inspected as follows:

- At least once every twelve months.
- After a severe rainfall event in which it is suspected that the Practice may have been compromised.
- At the request of the Stormwater Management Officer following a complaint of a potential violation or lack of routine maintenance for the Practice.

Inspection forms and representative photographs shall be electronically submitted to the Stormwater Management Officer for tracking within the procedures established in Exhibit 25.

Inspection Responsibility

Inspections shall be conducted by a responsible and qualified individual as follows:

- For municipally owned Practices, the inspection shall be performed by a Town representative, a Town TDE agent, or other approved qualified individual. Inspection forms for various Practices are included as a part of this exhibit, and may be used as required. The TDE or other qualified individual may use internally developed inspection forms, if desired.
- For privately owned Practices, the inspection shall be performed by a qualified agent, hired by the Owner, using the Town inspection forms or internally developed inspection forms, if desired. The Town will also, at its discretion but at least once every twelve months, or upon the receipt of a complaint, conduct its own inspection of privately owned Practices to verify their maintenance and operation.

Corrective Measures

Based upon the results of the inspection, the Owner will be notified that deficiencies have been found during an inspection of the Practice. It will be the Owner's responsibility to develop a remediation plan to address the noted deficiencies, including a schedule of completion, and submit said plan to the Stormwater Management Officer. Once the plan has been implemented, the Town, or an approved designee, will verify that the remediation plan has been fully executed.

Enforcement Policy

Once notified that corrective measures are required, the Owner will be given a timeframe to develop and implement a remediation plan based upon the nature and severity of the deficiencies.

If the Owner fails to develop or implement a remediation plan, the Town will take the following enforcement actions, in escalating order:

- Second written notification of violation and reiteration of expected action.
- Issuance of Stop Work order, if applicable.
- Issuance of Notice of Violation from Code Enforcement Officer, if applicable.
- Court action, revocation of operational permit, tax levies, and fining, if applicable.
- Referral to New York State Department of Environmental Conservation, Army Corps of Engineers, or other jurisdictional body as may apply.

Bioretention Operation, Maintenance and Management Inspection Checklist

Project Title: _____
 Location: _____
 Site Status: _____
 Practice ID#: _____ Town of NG Project Number: _____
 Inspection Date: _____ Inspection Time: _____
 Inspector: _____ Weather: _____

Inspection/Maintenance Item	Condition	Comments
I. Debris Cleanout		
A. Bioretention and contributing areas clean of debris		
B. No dumping of yard wastes into practice		
C. Litter (branches, etc) have been removed		
II. Vegetation		
A. Plant height not less than water depth		
B. Fertilized per specifications		
C. Plant composition according to approved plans		
D. No placement of inappropriate plants		
E. Grass height not greater than 6 inches		
F. Excessive sediment accumulated inside riser		
G. No evidence of erosion		
III. Check Dams/Energy Dissipaters/Sumps		
A. No evidence of sediment buildup		
B. Sumps not more than 50% full of sediment		
C. No evid. of erosion at downstr.vtoe of drop structure		
IV. Dewatering		
A. Dewaterers between storms		
B. No evidence of standing water		
V. Sediment Deposition		
A. Swale clean of sediments		
B. Sediment not greater than 20% of swale design depth		
VI. Outlet/Overflow Spillway		
A. Good condition, no need for repair		
B. No evidence of erosion		

Bioretention Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
C. No evidence of any blockages		
VII. Integrity of Filter Bed		
A. Filter bed has not been blocked/filled inappropriately		

Comments:

Summary of Required Actions:

Infiltration Trench Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
I. Debris Cleanout		
A. Trench surfaces clear of debris		
B. Inflow pipes clear of debris		
C. Overflow spillway clear of debris		
D. Inlet area clear of debris		
II. Sediment Traps or Forebays		
A. Obviously trapping sediment		
B. Greater than 50% of storage volume remaining		
III. Dewatering		
A. Evidence that trench dewateres during storms		
IV. Sediment Cleanout of Trench		
A. No evidence of sediment in trench		
B. Sediment accumulation doesn't yet require cleanout		
V. Inlets		
A. Good Condition		
B. No evidence of erosion		
VI. Outlet/Overflow Spillway		
A. Good condition, no need for repair		
B. No evidence of erosion		
VII. Aggregate Repairs		
A. Surface of aggregate clean		
B. Top layer of stones does not need replacement		
C. Trench does not need rehabilitation		

Infiltration Trench Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Comments:

Summary of Required Actions:

Open Channel Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
I. Debris Cleanout		
A. Contributing areas clean of debris		
II. Check Dams or Energy Dissipators		
A. No evidence of flow going around structures		
B. No evidence of erosion at downstream toe		
C. Soil permeability		
D. Groundwater/bedrock		
III. Vegetation		
A. Mowing completed		
B. Minimum mowing depth not exceeded		
C. No evidence of erosion		
D. Fertilized per specifications		
IV. Dewatering		
A. Dewaterers between storms		
V. Sediment Deposition		
A. Clean of sediment		
VI. Outlet/Overflow Spillway		
A. Good condition, no need for repairs		
B. No evidence of erosion		

Open Channel Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Comments:

Summary of Required Actions:

Sand/Organic Filter Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
I. Debris Cleanout		
A. Contributing areas clean of debris		
B. Filtration facility clean of debris		
C. Inlets and outlets clear of debris		
II. Oil and Grease		
A. No evidence of surface clogging		
B. Activities in drainage area minimize oil/grease entry		
III. Vegetation		
A. Contributing drainage area stabilized		
B. No evidence of erosion		
C. Area mowed and clippings removed		
IV. Water Retention Where Required		
A. Water holding chambers at normal pool		
B. No evidence of leakage		
V. Sediment Deposition		
A. Filter chamber free of sediments		
B. Sediment chamber not more than half full of sediments		
VI. Structural Components		
A. No evidence of structural deterioration		
B. Grates in good condition		
C. No evidents of spalling/cracking of structural parts		
VII. Outlet/Overflow Spillway		
A. Good condition, no need for repairs		
B. No evidence of erosion (if draining to natural channel)		

Sand/Organic Filter Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
VIII. Overall Function of Facility		
A. Evidence of flow bypassing facility		
B. No noticeable odors outside of facility		

Comments:

Summary of Required Actions:

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
I. Embankment/Spillway		
A. Vegetation and ground cover adequate		
B. Embankment Erosion		
C. Animal burrows		
D. Unauthorized Planting		
E. Cracking, bulging or sliding of dam at:		
1. Upstream face		
2. Downstream face		
3. At or beyond toe upstream		
4. At or beyond toe downstream		
F. Pond, toe and chimney drains clear and functioning		
G. Seeps/leaks on downstream face		
H. Slope protection or riprap failure		
I. Vertical/horizontal alignment of top of dam "as-built"		
J. Emergency spillway clear of obstructions and debris		
K. Other		
II. Riser and Principal Spillway		
	Type: __ Reinf Conc __ Pipe __ Masonry	
A. Low orifice obstructed		
B. Low flow trash rack debris removal necessary		
C. Low flow trash rack corrosion control		
D. Weir trash rack debris removal necessary		
E. Weir trash rack corrosion control		
F. Excessive sediment accumulated inside riser		
G. Concrete/masonry riser and barrels		
1. Cracks or displacement		

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
2. Minor spalling (<1")		
3. Major spalling (exposed rebar)		
4. Joint failures		
5. Water tightness		
H. Metal pipe condition		
I. Control valve		
1. Operational/exercised		
2. Chained and locked		
J. Pond drain valve		
1. Operational/exercised		
2. Chained and locked		
K. Outfall channels functioning		
L. Other		
III. Permanent Pool (Wet Ponds)		
A. Undeirable vegetative growth		
B. Floating debris removal required		
C. Visible pollution		
D. Shoreline Problem		
E. Other		
IV. Sediment Forebays		
A. Sedimentation noted		
B. Sediment cleanout when depth <50% design		
V. Dry Pond Areas		
A. Vegetation adequate		
B. Undesirable vegetative growth		

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
C. Undesirable woody vegetation		
D. Low flow channels clear of obstruction		
E. Standing water or wet spots		
F. Sediment and/or trash accumulation		
G. Other		
VI. Condition of Outfalls		
A. Riprap failures		
B. Slope erosion		
C. Storm drain pipes		
D. Endwalls/Headwalls		
E. Other		
VII. Other		
A. Encroachment on pond, wetland or easement area		
B. Complaints from residents		
C. Aesthetics		
1. Grass growing required		
2. Graffiti removal required		
3. Condition of maintenance access routes		
4. Signs of hydrocarbon build-up		
5. Public hazards		
6. Other		
VIII. Wetland Vegetation		
A. Vegetation healthy and growing (50%)		
B. Dominant wetland plants		
1. Survival of desired wetland species		

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project Title: _____

Location: _____

Site Status: _____

Practice ID#: _____

Town of NG Project Number: _____

Inspection Date: _____

Inspection Time: _____

Inspector: _____

Weather: _____

Inspection/Maintenance Item	Condition	Comments
2. Distribution according to landscaping plan		
C. Evidence of invasive species		
D. Adequate water depth for desired plant species		
E. Harvesting of emergent plantings needed		
F. Sediment accumulation reduced pool volume		
G. Plants choked with sediment		
H. Eutrophication level of wetland		
I. Other		

Comments:

Summary of Required Actions:

Exhibit 27

Pollution Prevention and Good Housekeeping for Municipal Operations

Pollution Prevention Philosophy

The following basic principles are intended to reduce pollution, increase efficiency, and reduce cost for Municipal Operations.

- *Prevent Pollution at its Source*

Controlling pollutants at their source and preventing their wider release is more effective, efficient and cost-effective than removing them from stormwater runoff or implementing other water treatment options after the fact. Every attempt should be made to remove or capture contaminants before stormwater contact.

- *Manage Clean Water Runoff and Minimize Pollutant Exposure to Clean Water*

Prevent clean water runoff and precipitation from contacting potential pollutants and prevent mixing of clean water (runoff) with polluted flows.

- *Minimize Use of Potential Pollutants*

Examine municipal use of all chemicals and other potential pollutants and identify methods of eliminating, reducing or better targeting their use in municipal operations and facilities.

- *Plan and Prepare for Spills and Accidents*

Develop spill prevention and response policies and procedures for all facilities that use or store chemicals.

- *Practice Preventive Maintenance*

Regularly inspect components of stormwater collection, conveyance and treatment systems; regularly inspect machinery, pipes, storage tanks and other equipment for leaks or worn parts; regularly calibrate application equipment; and plan for system upgrades and component replacements and repairs.

- *Identify Potential Pollution Sources*

Identify municipal facilities and operations that could impact stormwater quality. Identify potential pollution sources at each site or for each activity. Identify, map and inspect the facility's stormwater drainage system.

- *Plan New Facilities to Include Stormwater Pollution Prevention*

Include a stormwater pollution prevention component in all new municipal facilities and activities. Site new facilities to minimize waterbody impacts. Use Best Management Practices when preparing facility plans or major upgrades.

- Improve Data Collection, Mapping, and Records Maintenance

Emphasize improvement of data collection and records maintenance to address higher priority pollution sources and contaminants; improvement of geographic information; and unification of data management across all relevant municipal departments and operations.

- Train Employees

Train employees regarding stormwater pollution and prevention practices. Identify emergency contacts and reporting procedures. Seek employee ideas on pollution prevention methods.

- Improve Communications and Coordination

Emphasize communication and coordination across key municipal departments and operations. Coordinate stormwater and pollution prevention activities with county and state agencies, organizations and institutions, as well as neighboring municipalities. Develop public outreach and citizen participation regarding municipal pollution prevention activities.

Street and Bridge Maintenance

- Street Cleaning Priorities

Streets whose drainage systems that flow into priority water bodies listed below are first priority for cleaning and maintenance:

- 303(d) water bodies;
- Sensitive habitats; and
- Drinking water bodies and their tributaries.

Streets whose drainage systems that flow into water bodies and streams that are trout spawning (A(TS), B(TS), or C(TS)) are second priority.

Streets whose drainage systems that flow into water bodies not listed above are third priority.

- Sensitive Ecosystems or Priority Waterbody Considerations

The following waterbodies are listed in the NYS DEC's 303(d) listing for the following pollutants:

- Snyders Lake ó Phosphorus
- Hudson River ó PCBs (reference)

The following waterbodies are drinking water bodies:

- Tomhannock Reservoir (reference)

The following waterbodies are listed as trout spawning:

- Wynantskill Creek
- Poestenkill Creek (reference)

- *Pollution Prevention and Streambank Erosion Control in Bridge Maintenance*

The following general measures are to be employed when working in the vicinity of stream beds or bridges:

- Use suspended tarps, booms and vacuums to capture pollutants (e.g. paint, solvents, rust and paint scrapings) generated during bridge maintenance. Ensure that contractors do the same;
- Use the appropriate stormwater and erosion control techniques when doing work along stream banks;
- Seed and mulch after disturbing stream banks;
- Routinely clean scupper drains, especially those that drain directly to surface waters; and
- When rehabilitating a bridge with scupper drains that drain directly to surface waters, retrofit the scupper drains with catch basins or redirect the water to vegetated areas on land.

- *Maintenance of Unpaved and Rural Roads*

For work associated with drainage ditches the following measures are to be considered:

- Open drainage ditches should be inspected annually;
- Ditches should be cleaned out or restored when the ditch is silted in to half its depth, flooding regularly occurs on the road, or additional drainage is needed to maintain the roadway;
- Freshly dug ditches will be seeded. Ditches with a slope greater than ten percent (10%) should have rip-rap or geotextiles installed to prevent erosion and scouring of the ditch;
- Vegetation ditches should be mowed regularly;
- Culverts are to be properly sized to keep ditches drained and reduce scouring and erosion; and
- Culverts should be inspected and cleaned out to avoid clogging, washouts and settlement.

Erosion control can be improved by the implementation of several practices:

- Road banks, ditches, and shoulders should be seeded, if disturbed, once work ends;

- The roadbed should be crowned to encourage water to drain into the ditch and not run down the roadbed;
- Limit disturbed areas;
- Stabilize disturbed areas as soon as practicable;
- Retain vegetation on site, if possible;
- Keep stormwater from running onto site with diversion ditches or other similar methods;
- Retain sediment at work sites by filtering water, using erosion control methods or by using settling ponds; and
- Follow up and inspect recent work. Make sure that all erosion controls are in place and working properly. Make sure that stabilized sites remain stabilized.

Dust control on unpaved roads:

- Calcium chloride or a similar material should be sprayed on the roadbed to control fugitive dust.

Roadside maintenance should consider the following:

- Maintain vegetation by mowing;
- Herbicide should only be used in places where mowing is very difficult to impossible. Use of chemicals such as herbicides and pesticides should be limited near bodies of water.
- Litter control can be increased by encouraging neighborhoods to pick up the litter from roadsides by having an Adopt-A-Road program or by using work force or community groups to remove litter from ditches and along roadways.

Stormwater Drainage, Conveyance and Treatment System Maintenance

- *Priority Determination for Systems and System Components*

Stormwater drainage systems that flow into priority water bodies listed below are first priority for cleaning and maintenance:

- 303(d) water bodies;
- Sensitive habitats; and
- Drinking water bodies and their tributaries.

Stormwater drainage systems that flow into water bodies and streams that are trout spawning (A(TS), B(TS), or C(TS)) are second priority.

Stormwater drainage systems that flow into water bodies not listed above are third priority.

- Inspection of System Components, Record-Keeping and Frequency Tracking

The following general items should be considered when inspecting municipal stormwater systems:

- Records should be kept of all inspections of stormwater drainage facilities;
- A log should be kept of the drainage system inspected, receiving waters, priority of the drainage system, when inspections are made, and the time past between the last inspection of the facility;
- All first priority drainage systems should be inspected at least once a year;
- All second priority drainage systems should be inspected at least once a year;
- All third priority drainage systems should be inspected at least every eighteen months; and
- Drainage systems that appear to require cleanout or maintenance more frequently than expected should be inspected at least every six months.

- Technology Improvements and Installation

In areas where pollution or siltation is shown to be a problem, technological improvements and retrofits should be installed. Tracing problems to their origins and requiring remediation should be used according to the Town's Illicit Discharge Detection and Elimination Law.

- Maintenance, Repair and Cleanout of System Components

The upkeep of Stormwater Drainage Systems should consider the following:

- At the time of inspection, notation on whether a system required cleanout, regular maintenance or repair should be made. If the system is clogged, filled, eroded or similarly impaired to the point of ineffectiveness or hazard, a notation should be made to have the system cleaned/repared immediately;
- Needed cleanout, maintenance or repair should be the responsibility of the Highway Department. Impaired and hazardous systems should have a high priority;
- Siltation should be removed from wet pond forebays, and ditches when they are fifty percent (50%) filled. Culverts should be cleaned before siltation creates flooding problems;
- Enclosed drains should be cleaned regularly by either flushing or vacuuming; and
- Trash should be regularly collected from grates or grilles.

- Public Education and Communications

The public is key to helping maintain stormwater drainage systems. Maintaining open communication with the public will help in identifying problem systems as well as reducing costs of cleanup by promoting citizen responsibility. Educational articles in local papers and on the Town's website; Public Hearings; public education seminars; and the distribution of informative literature should be used to engaged the public.

Parks, Open Space and Municipal Property Maintenance

The following items should be considered for municipal grounds maintenance:

- *Integrated Pest Management*

The application of integrated pest management controls will be used for minimizing both weed and insect infestation. This control method checks for the variety of weeds and insects that may be creating problems, and using the proper herbicide or insecticide at the proper time to deal with the problem. If no weeds or insect pests are found, no herbicides or insecticides will be used. The Rensselaer County Cooperative Extension will be used to instruct personnel on the use of this method. Records of the application of herbicides and pesticides should be kept by the applicator.

- *Use of Pesticide Alternatives*

Non-chemical and natural pesticide alternatives will be used where such alternatives are reasonably priced and applicable.

- *Fertilizer Use, Alternatives and Reductions*

In an attempt to reduce the application of chemicals, the following should be considered:

- Soils should be tested yearly for areas that require fertilizer use. Only if soil fertility levels are less than optimal should fertilizers be used;
- Fertilizers shall only be used following instructions given on the package, and at rates prescribed to ameliorate soil fertility; and
- Alternatives to chemical fertilizers such as manure, mulches and compost should be used where possible to improve soil fertility.

- *Erosion Control Practices*

For locations subject to higher traffic:

- In areas where grass is worn due to foot traffic, alternatives to grass such as mulch, gravel or a paved path should be used to prevent soil erosion where grass is lacking; and
- In areas of new lawn seeding, hay mulch should be used to maintain moisture and prevent erosion until the new grass is growing.

- *Waste Reduction, Recycling and Litter Control*

The following waste control measures should be considered:

- In remote or low-traffic areas, a Carry-In/Carry-Out waste policy is in effect. Signage indicating this control measure should be posted at access points;

- Trash barrels and waste cans should be located in high-traffic areas to provide facilities for patrons to use. The trash barrels and waste cans will be emptied on a weekly/daily basis as required;
 - In areas where dumping is an issue, signs will be placed reminding the public of fines for dumping and littering; and
 - Recycling containers will be located at high-traffic areas, where practicable.
- Hazardous Materials Storage

In the event that the storage of hazardous materials is required:

- All hazardous materials shall be stored inside, under cover or protective tarp, or in an appropriate bulk tank;
- Aisle space should be wide enough to allow access for inspections and to ease material transport;
- Materials should be stored away from high-traffic areas to reduce the likelihood of accidents that may cause spills or damage to drums, bags or containers;
- Containers should be stacked according to manufacturer's directions to avoid damaging the container or product itself; and
- Containers should be stored on pallets or equivalent structures to facilitate inspection for leaks and prevent containers from coming in contact with wet floors, which can cause corrosion. This also reduces the incidence of damage by pests.

Onsite Septic Systems

For municipal spaces with onsite septic systems, the following shall be implemented:

- Inventory of Existing Septic Systems

An inventory of municipal parks septic systems will be kept on file in the Building Department, listing the property, location on the property, date of installation, size of septic tank, and type of leach field. A copy of plans of the septic systems will be kept with the inventory.

- Inspections and Record Keeping

Each septic system will be inspected biannually by the Building Department. Any odors from the system will be noted. If leachate is visible or the leach field is swampy, corrective actions will be taken. Records of inspections will be maintained with the inventory.

- Pumpouts and Maintenance

The septic systems will be pumped out on a regular basis, depending on size and usage, by qualified personnel. Inspections of the septic tank will be taken at the time of pumpout, and necessary repairs made if necessary.

Animal Waste Management

To minimize the impact of animal waste on municipal grounds, the following shall be considered:

- *Pet Waste Control, Education and Enforcement*
 - Pet owners are required to pick up pet wastes from parks, streets and sidewalks;
 - Signs in parks will remind pet owners of this requirement; and
 - Trash cans in parks will assist pet owners in the removal of pet wastes.
- *Bird Waste Control*
 - DEC and US Fish and Game Office will be contacted when wild birds amass and congregate regularly in areas; and
 - Sidewalks and streets that have accumulated bird droppings will be swept by machine or broom.
- *Domestic Animals (Fairgrounds, Municipal Farms, Equestrian Center)*
 - Domestic animal wastes will be swept up from paved areas such as sidewalks and parking lots;
 - Domestic animal wastes will be stored in an appropriate area in an appropriately constructed manure pit or pile; and
 - Odor control may be necessary for the manure pile or pit.

- *Wildlife*

To prevent waste from wildlife from contaminating stormwater, wildlife shall be discouraged from massing or straying onto public property, especially on public waterfronts or parks. This may be accomplished through non-lethal methods such as use of cannons and dogs, as well as lethal methods.

- *Public Education and Communication*
 - Educational materials such as signs, pamphlets and handouts, as well as communications through newsletters, newspaper articles and billboard ads will be used to communicate the importance of cleaning up after pets; and
 - Newspaper articles and other media communications will be used for informing the public of methods to be used for wildlife removal.

Solid Waste Management

The following solid waste management practices shall be considered:

- *Prevention of Illicit Dumping*

- Illicit dumping on Town highways is made illegal in the Illicit Discharge Detection and Elimination Law;
- Those found dumping, as well as those who are identified by their waste will be fined and their names may be posted in the newspaper or other public place; and
- Sites with continual dumping may have signs installed informing the public of the illegal nature of dumping. Articles in the newspaper and town's newsletter will also inform readers of the illegality and negative consequences of dumping.
- Litter Control
 - Littering on town highways and town lands is made illegal in the Illicit Discharge Detection and Elimination Law;
 - Those found littering may be fined or remanded to community service. Those found littering may also have their names posted in the newspaper or other public place;
 - Sites with continual littering may have signs installed informing the public of the illegal nature of littering or of the implications of littering; and
 - Waste bins or barrels at parks and other places should be emptied weekly or more often when full to keep trash in its place.
- Waste Reduction and Recycling
 - Purchase and maintain only the supplies or materials needed, although a bid can set the price for additional materials beyond that purchased;
 - Encourage recycling of paper and other materials;
 - For offices, print double-sided and cull mailing lists to save paper; and
 - Encourage the use of washable dishware and cups/mugs in the lunchroom instead of paper plates and Styrofoam cups.
- Hazardous Waste Collection (including from Municipal Buildings)
 - Municipally generated hazardous waste will be disposed of in a legal, appropriate fashion;
 - Hazardous waste will be properly stored inside where the waste will be labeled properly; and
 - Hazardous waste will be removed by a hauler licensed to haul hazardous substances to a facility that is licensed to either recycle or dispose of hazardous waste substances.

Streambank Stabilization and Hydrologic Habitat Modification

The following general items shall be considered during the design or implementation of projects or work near streams or other hydrologically sensitive areas:

- Priority Setting for Streambank Stabilization Projects

- First priority for streambank stabilization projects will be for areas where life or property, including roadways, is at risk from erosion or flooding from siltation;
 - Second priority for streambank stabilization is where important habitats or other ecological importance is threatened due to erosion or siltation;
 - Third priority for streambank stabilization is where situation threatens hydro facilities or threatens dam workings or bridges; and
 - Fourth priority for streambank stabilization is any need not listed above.
- *Opportunities for Alternative, Soft-Engineering Approaches for Erosion Control*

When possible, use of soft-engineered approaches for erosion control should be used, such as plantings of osiers, use of geotechnical materials and other proven methods to stabilize stream and water body banks.

- *Priority Setting for Sediment Removal and Pond Maintenance*
 - Sediments must be removed from stormwater detention pond forebays when the forebays are half full; and
 - Sediment should be removed on a scheduled basis, preferably before it becomes necessary as specified by the item above.
- *Opportunities for Hydrologic Habitat Improvements*
 - Naturally occurring and man-made lakes and ponds that have a significant sedimentation problem should be investigated as to whether a sedimentation forebay should be constructed at major stream inlets or at stream areas and stormwater outfalls that are growing deltas; and
 - Careful removal of sedimentation from wetlands that are becoming silted in should be investigated.
- *Application of Fluvial Geomorphic Assessments in Erosion Control Projects*
 - Natural flooding and flood plains should be taken into account in erosion control projects; and
 - Erosion control projects should not increase flooding upstream.
- *Opportunities for Community Sponsored Volunteer Stream Walks*
 - Similar to the Adopt-a-Highway program, volunteer stream walks and adoption of streams and other water bodies will be encouraged as a method of improving the hydric environment; and
 - Use of required stream clean up as part of the sentence of littering or other improper disposal method shall be considered.

Personnel Training, Documentation and Scope

The Town has developed a training matrix for relevant municipal employees. More specifically, this includes members of the Highway Department, Utilities Department, and Building Department associated with field or site services or inspections. For each training session, the Title, Date, and Scope of Training as well as a Personnel Sign-in Sheet shall be submitted to the Stormwater Management Officer.

For 2021, the following Training Matrix has been developed to represent the minimum training requirements for relevant municipal staff.

Training	Scope	Required Departments
North Greenbush's Updated SWMP Plan	A review of the revised SWMP Plan, including formal documentation of SWMP Plan activities	Building Department Highway Department Utilities Department
Four-Hour Erosion and Sediment Control Training	Principals of erosion and sediment control	Building Department (if required, every three years)
Municipal Equipment Maintenance, Fueling and Fuel Storage	BMPs associated with preventing environmental impacts from routine maintenance and fueling of municipal vehicles and equipment and the storage of fuels at municipal facilities	Highway Department
Municipal Property Maintenance	Training and BMPs on clean-up techniques, proper materials storage, chemicals usage, and safety.	Building Department Highway Department Utilities Department
Outfall Inspections	Procedures and guidelines for inspecting or observing outfalls during planned inspections or routine maintenance	Building Department Highway Department Utilities Department
IDDE Program	Principals of the IDDE Program and identifying potential IDDE violations	Building Department Highway Department Utilities Department

Exhibit 28

Highway Department Vehicle and Garage Operation and Maintenance Procedures

General Information:

- The Town of North Greenbush has approximately 48 vehicles in its vehicle fleet including the Highway Department, Utility Department, Building Department and Police Department.
- All fluid change work is performed in the Highway Garage by the Highway Department mechanics.
- Each vehicle is given oil changes approximately every 5,000 miles.
- Used vehicle oil is drained into mobile waste oil reservoirs and transferred to a 275-gallon main waste oil tank located in a steel secondary containment well.
- One spill kit is located in the mechanic's area in the garage to contain small spills per the adopted Spill Response Procedures.

Wastewater Disposal and Treatment from Vehicle Washing:

- All Highway Department vehicles are washed at the Highway Garage, which has a floor drain with silt collection chamber (contractor cleans out as needed) before discharging to a sewer line.
- Vehicle washing is done in areas designed to collect and hold the wash and rinse water or effluent generated.
- Floor drain silt is removed by vacuum truck as needed.

Site Drainage System Maintenance and Cleanout:

- Catch basins are pumped out regularly or before they are fully filled.
- External drains are examined yearly or more often to make sure that no oils, solvents or other hazardous materials leave the Highway Garage area.

Recycling (including Oil and Antifreeze):

- Promptly transfer old fluids to used waste oil tanks for recycling pick-up.

Hazardous Materials Storage:

- All hazardous materials shall be stored inside, under cover or protective tarp, or in an appropriate bulk tank.
- Aisle space should be wide enough to allow access for inspections and to ease material transport.
- Materials should be stored away from high-traffic areas to reduce the likelihood of accidents that may cause spills or damage to drums, bags or containers.
- Containers should be stacked according to manufacturer's directions to avoid damaging the container or product itself.
- Identify all hazardous and non-hazardous substances present in a facility. Compile a list of all chemicals present in a facility and obtain a Safety Data Sheet (SDS) for each one.

Spill Prevention and Response (Petroleum and Other Substances):

- All liquid cleaning should be performed at a centralized station within the Highway Garage to ensure that solvents and residues stay in one place.
- Locate drip pans and draining boards to direct solvents back into solvent sink or holding tank for reuse.
- Promptly transfer used fluids to recycling waste oil tank or hazardous waste containers.
- Conduct maintenance work such as fluid changes indoors.
- Parked vehicles should be monitored closely for leaks, and pans placed under any leaks to collect fluids for proper disposal or recycling.
- Batteries are not stored.
- Use speedy-dry and not water as possible to clean spills, leaks and drips.
- Rags should be used to clean up small spills, dry absorbent materials for large spills, and a mop for general cleanup. Mop water can be disposed of via the sink or toilet to the sewer.
- Other incidental leaks are collected in the garage floor drain which leads to an oil separator which is cleaned every 6 months by an outside contractor.

Solid Waste Disposal:

- Solid waste is kept in appropriate garbage bins and barrels and disposed of in appropriate facilities.

Alternative Product Usage:

- Use non-hazardous cleaners when possible.
- Bio-degradable soaps are used for vehicle washing.
- Recycled products such as engines, oil, transmission fluid, antifreeze, and hydraulic fluid can be purchased to support the market of recycled products.

Responsibility:

- Highway Superintendent

Exhibit 29

Highway Garages Fuel and Petroleum Storage and Use Procedures

Engine Oil:

- Engine oil is stored in 50-gallon drums inside the garage and sits inside a concrete secondary containment area with a spill catching pad under the dispenser pump.

Brake Fluid:

- No schedule for replacement - approximately 1/2 gallons used per year.
- One case of new product is stored in the mechanics locked area.
- Used product is added to the used waste oil tank.

Transmission Fluid:

- No set schedule for replacement - approximately 25 gallons changed per year.
- 100 quarts of new product is stored in the mechanics locked area.
- Used product is added to used waste oil tank.

Diesel Fuel:

- Stored within Highway Department's garage in double-walled tank with an emergency shutoff for the dispensing pump.
- Filling procedure - driver will monitor fuel lines at all times.
- Physical barriers prevent any vehicles from backing into the tank.

Gasoline Fuel:

- Stored within Highway Department's Garage in double-walled tank with an emergency shutoff for the dispensing pump.
- Filling procedure - driver will monitor fuel lines at all times.
- Physical barriers prevent any vehicles from backing into tank.

Responsibility:

- Highway Superintendent

Exhibit 30

Highway Garages Salt Storage and Use Procedures

Provide proper storage and application of road salt to reduce the impact of salt on plants, aquatic life, and the local water bodies.

Standard Operating Procedures:

- Train operators on environmental hazards of over-salting roads.
- Identify areas particularly susceptible to contamination in the MS4 area.
- Use covered facility for salt storage (prevents lumping and run-off loss).
- Store salt on highest ground elevation to mitigate contact with stormwater.
- Calibrate salt spreaders as necessary.
- Mix sand and salt 50% / 50%.
- Consider alternative deicing materials (i.e. calcium chloride, magnesium).
- If possible, use a wetting agent with salt to minimize "bouncing" during spreading.
- Unload salt deliveries directly into storage facility, or if not possible, move it in as soon as possible.
- Inspect salt storage shed for leaks, other problems. Repair as needed.
- Inspect salt piles for proper coverage, and inspect tarps for leaks or tears.
- Inspect salt application equipment.
- Inspect salt regularly for lumping or water contamination.
- Inspect surface areas for evidence of runoff - salt stains on ground near storage areas.
- Inspect for excessive amounts of salt on roads.
- Inspect equipment to verify proper operation and calibrate as needed.
- Calibration of salt spreaders regularly to ensure accurate, efficient distribution of salt and sand.
- The Highway Department utilizes a "Road Salt Storage and Application Inspection Form" to document inspections the salt storage areas.

Street Plowing & Snow Storage:

- When the Superintendent of Highways determines that snow or ice accumulation along Town roads is excessive it is collected into dump trucks and brought to the Fane's Gravel Pit on NYS Route 66 where it is stockpiled as well as the vacant lot at the Town's Highway Department.
- Snow is plowed curb to curb and stored between curbs and sidewalks as feasible.

Road and Highway De-Icing:

- Highway Department applies 50% / 50% rock-salt and sand mixture to roads to avoid sedimentation to its MS4 and CSO systems as much as possible.
- Highway Department applies salt / sand at intersections as needed and the traffic distributes the salt / sand mixture down the road as needed.
- All salt deliveries go to the Highway Department's salt storage shed at the Highway Garage.
- The Highway Department currently utilizes the following equipment:
 - 6 Plow Trucks (10-Ton).
 - 2 Plow Trucks (1-Ton).

- 6 Large mechanical spreaders (6 -8-Ton capacity chain-driven).
- 2 Small mechanical spreaders (1-Ton capacity chain-driven).

Vehicle Maintenance:

- Trucks are cleaned after each storm with power washer in the Highway Department's garage with effluent going to oil-water separator.

Application Procedure:

- Equipment response is according to the severity of the storm:
 - Less than 1 inch of snow: 3 small trucks.
 - Major storm: entire fleet.
- In a major snow storm roads are plowed only and salt / sand is withheld until storm is over.
- When de-icing begins, hills and bridges are prioritized and then crews branch to zones for distribution as needed on other Town roads.
- Approximately 60 total miles and several municipal parking lots are serviced by the Highway Department.
- Loading Procedure: A front-end loader (2-1/2 yard capacity bucket) is used to remove salt / sand from the stockpiles and to place it into the spreader.
- Any ground spills are pushed back into the stockpile.
- At the end of de-icing work, trucks are driven back to the salt stockpile to unload any remaining salt / sand back into stockpile.

Responsibility:

- Highway Superintendent

Exhibit 31

SWMP Annual Budget

The Town's budget for the Stormwater Management Procedure Plan and other stormwater related activities is included in the annual Highway Department Budget and the annual Utilities Department Budget. These budgets include costs for items such as cleaning catch basins, sweeping streets and sidewalks, brush and leaf pick up, water system operation and maintenance, sanitary sewer operation and maintenance, weekly construction inspections, training, storm sewer television, inter-municipal agreement, distribution of stormwater information and personnel.

The Stormwater budget, labeled as "Reserve (Drainage Maintenance)" in the attached partial copy of the Town budget, has been increased from \$7,000 to \$20,000 for 2021. The Town is currently working on other means to increase the Stormwater budget for future years, including:

- Grants.
- The creation of Stormwater Management Districts.
- Stormwater Mitigation Fees associated with larger subdivisions or commercial development.

The Town will also develop a more comprehensive and itemized budget plan for future SWMP revisions.

**Final
Town of North Greenbush
Budget
For 2021**

**Town of North Greenbush, County of Rensselaer,
State of New York**



Certification of Town Clerk

I, Janice Kerwin, Town Clerk, certify that the following is a true and correct 2021 Final Budget of the Town of North Greenbush, as adopted by the Town Board on this 5th day of November 2020.

Signed: Janice Kerwin **Date:** 11/6/2020
Town Clerk



SUMMARY OF TOWN OF NORTH GREENBUSH FINAL 2021 BUDGET				TAX RATE	TAX LEVY
FUND	Appropriations And Provisions For Other Uses	Less Estimated Revenues	Less Unexpended Balance	Amount To Be Raised By Taxes	Cost/Asses. \$1000 or O&M Rate
A - General Fund	\$ 5,209,316	\$ 3,704,032	\$ 24,534	\$ 1,480,750	\$ 4.85
DA - Highway-Townwide	\$ 1,868,863	\$ 130,000	\$ -	\$ 1,738,863	\$ 5.70
SL - Wynantskill Lighting	\$ 35,000	\$ -	\$ -	\$ 35,000	\$ 0.81
SL - Mountain View Lighting	\$ 594	\$ -	\$ -	\$ 594	\$ 0.78
SL - Sharpe-Milhizer Lighting	\$ 4,500	\$ -	\$ -	\$ 4,500	\$ 0.80
SL - Van Allen Park Lighting	\$ 1,175	\$ -	\$ -	\$ 1,175	\$ 1.24
SL - Hampton Place Lighting	\$ 600	\$ -	\$ -	\$ 600	Assoc. Pays
SF- N. Greenbush Fire District	\$ 1,421,030	\$ -	\$ -	\$ 1,421,030	\$ 4.08
SM - N.Greenbush Ambulance Dist.	\$ 312,485	\$ -	\$ -	\$ 312,485	\$ 0.90
L - N.Greenbush Library District	\$ 319,883	\$ -	\$ -	\$ 319,883	\$ 0.92
SS - Wynantskill Sewer 4 (#30)	\$ 99,939	\$ -	\$ -	\$ 99,939	\$ 57.02
SS - Snyder's Lake Sewer 5 (#32)	\$ 53,837	\$ -	\$ -	\$ 53,837	\$ 57.02
SS - Van Allen Park Sewer 6 (#33)	\$ 15,795	\$ -	\$ -	\$ 15,795	\$ 57.02
SS - RPI Sewer 7 (#34)	\$ 25,784	\$ -	\$ -	\$ 25,784	\$ 57.02
SS - Bloomingrove Sewer 8 (#35)	\$ 40,196	\$ -	\$ -	\$ 40,196	\$ 57.02
SS - Glenmore Road Sewer 9 (#36)	\$ 7,196	\$ -	\$ -	\$ 7,196	\$ 57.02
SS - Daniella Place Sewer 10 (#37)	\$ 3,980	\$ -	\$ -	\$ 3,980	\$ 57.02
SS - RCSWA Sewer 11 (#38)	\$ 13,685	\$ -	\$ -	\$ 13,685	\$ 57.02
SS - Route 4 Sewer 12 (#39)	\$ 42,879	\$ -	\$ -	\$ 42,879	\$ 57.02
SS- Winter ST Sewer 13 (#40)	\$ 8,838	\$ -	\$ -	\$ 8,838	\$ 57.02
SW - Water District 1 (#50)	\$ 27,780	\$ 21,590	\$ -	\$ 6,190	\$ 68.93
SW - Water District 2 (#51)	\$ 156,162	\$ 121,366	\$ -	\$ 34,796	\$ 68.93
SW - Water District 3 (#52)	\$ 128,530	\$ 71,165	\$ -	\$ 57,365	\$ 68.93
SW - Water District 4 (#53)	\$ 79,195	\$ 61,548	\$ -	\$ 17,647	\$ 68.93
SW - Water District 5A	\$ 80,741	\$ 62,751	\$ -	\$ 17,990	\$ 68.93
SW - Water District 5B	\$ 19,118	\$ 8,800	\$ -	\$ 10,318	\$ 68.93
SW - Water District 6 (#54)	\$ 210,269	\$ 121,751	\$ -	\$ 88,518	\$ 68.93
SW - Water District 7 (#55)	\$ 619	\$ 481	\$ -	\$ 138	\$ 68.93
SW - Water District 8 (#56)	\$ 742	\$ 577	\$ -	\$ 165	\$ 68.93
SW - Water District 10 (#57)	\$ 3,712	\$ 2,885	\$ -	\$ 827	\$ 68.93
SW - Water District 11 (#58)	\$ 78,929	\$ 46,594	\$ -	\$ 32,335	\$ 68.93
SW - Water District 12 (#59)	\$ 778,120	\$ 371,310	\$ -	\$ 406,810	\$ 68.93
SW - Water District 13 (#61)	\$ 240,824	\$ 97,035	\$ -	\$ 143,789	\$ 68.93
SW - Water District 13A	\$ 72,502	\$ 25,148	\$ -	\$ 47,354	\$ 68.93
SW - Water District 14 (#62)	\$ 814,840	\$ 307,454	\$ -	\$ 507,386	\$ 68.93
SW - Water District 16 (#64)	\$ 71,523	\$ 55,586	\$ -	\$ 15,937	\$ 68.93
SW - Town Wide Water District (#63)	\$ 302,750	\$ -	\$ -	\$ 302,750	\$ 0.87
SW - Water District RCSWA (#60)	\$ 77,029	\$ 59,866	\$ -	\$ 17,163	\$ 68.93
SW - Water District 17 (#65)	\$ 4,393	\$ 3,414	\$ -	\$ 979	\$ 68.93
SW - Water District 18 (#66)	\$ 51,460	\$ 21,061	\$ -	\$ 30,399	\$ 68.93
SDA - Route 4/43 Highway Imp. District	\$ 180,650	\$ -	\$ -	\$ 180,650	\$ -
TOTAL BUDGET	\$ 12,865,463	\$ 5,294,414	\$ 24,534	\$ 7,546,515	\$ -

12/4/2020

SUMMARY OF TOWN OF NORTH GREENBUSH TENTATIVE 2021 BUDGET				TAX RATE	TAX LEVY
	Appropriations And Provisions For Other Uses	Less Estimated Revenues	Less Unexpended Balance	Amount To Be Raised By Taxes	Cost/Asses. \$1000 or O&M Rate
FUND					
A - General Fund	\$ 5,209,316	\$ 3,704,032	\$ 24,534	\$ 1,480,750	\$ 4.85
DA - Highway-Townwide	\$ 1,868,863	\$ 130,000	\$ -	\$ 1,738,863	\$ 5.70
SL - Wynantskill Lighting	\$ 35,000	\$ -	\$ -	\$ 35,000	\$ 0.81
SL - Mountain View Lighting	\$ 594	\$ -	\$ -	\$ 594	\$ 0.78
SL - Sharpe-Milhizer Lighting	\$ 4,500	\$ -	\$ -	\$ 4,500	\$ 0.80
SL - Van Allen Park Lighting	\$ 1,175	\$ -	\$ -	\$ 1,175	\$ 1.24
SL - Hampton Place Lighting	\$ 600	\$ -	\$ -	\$ 600	Assoc. Pays
SF- N. Greenbush Fire District	\$ 1,421,030	\$ -	\$ -	\$ 1,421,030	\$ 4.08
SM - N.Greenbush Ambulance Dist.	\$ 312,485	\$ -	\$ -	\$ 312,485	\$ 0.90
L - N.Greenbush Library District	\$ 319,883	\$ -	\$ -	\$ 319,883	\$ 0.92
SS - NGCSD-1	\$ 118,157	\$ -	\$ -	\$ 118,157	\$ 57.02
SS - Wynantskill Sewer 4 (#30)	\$ 99,939	\$ -	\$ -	\$ 99,939	\$ 57.02
SS - Snyder's Lake Sewer 5 (#32)	\$ 53,837	\$ -	\$ -	\$ 53,837	\$ 57.02
SS - Bloominggrove Sewer 8 (#35)	\$ 40,196	\$ -	\$ -	\$ 40,196	\$ 57.02
SW - NGCWD-1	\$ 501,896	\$ 390,064	\$ -	\$ 111,832	\$ 68.93
SW - Water District 3 (#52)	\$ 128,530	\$ 71,165	\$ -	\$ 57,365	\$ 68.93
SW - Water District 5B	\$ 19,118	\$ 8,800	\$ -	\$ 10,318	\$ 68.93
SW - Water District 6 (#54)	\$ 210,269	\$ 121,751	\$ -	\$ 88,518	\$ 68.93
SW - Water District 11 (#58)	\$ 78,929	\$ 46,594	\$ -	\$ 32,335	\$ 68.93
SW - Water District 12 (#59)	\$ 778,120	\$ 371,310	\$ -	\$ 406,810	\$ 68.93
SW - Water District 13 (#61)	\$ 240,824	\$ 97,035	\$ -	\$ 143,789	\$ 68.93
SW - Water District 13A	\$ 72,502	\$ 25,148	\$ -	\$ 47,354	\$ 68.93
SW - Water District 14 (#62)	\$ 814,840	\$ 307,454	\$ -	\$ 507,386	\$ 68.93
SW - Town Wide Water District (#63)	\$ 302,750	\$ -	\$ -	\$ 302,750	\$ 0.87
SW - Water District 18 (#66)	\$ 51,460	\$ 21,061	\$ -	\$ 30,399	\$ 68.93
SDA - Route 4/43 Highway Imp. District	\$ 180,650	\$ -	\$ -	\$ 180,650	\$ -
TOTAL BUDGET	\$ 12,865,463	\$ 5,294,414	\$ 24,534	\$ 7,546,515	\$ -

12/4/2020

Note: O/M rates for Sewer and Water Districts without debt services have been consolidated as follows.

NGCSD-1 includes Sewer District #33, #34, #36, #37, #38, #39 and #40.

NGCWD-1 includes Water District #1, #2, #4, #5A, #7, #8, #10, #16, #RSCWA and #17.

Accounts	Code	Actual/Spent 2016	Actual/Spent 2017	Actual/Spent 2018	Actual/Spent 2019	Final 2020	Final 2021	Projected 2022	Projected 2023
HIGHWAY APPROPRIATIONS									
SUPER. OF HIGHWAYS									
Personal Services	DA5010.1	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
UNALLOCATED INSURANCE	DA1910.4	\$ 31,868	\$ 31,385	\$ 31,385	\$ 65,823	\$ 69,000	\$ 71,760	\$ 74,630	\$ 77,615
ENGINEERING SERVICES	DA5110.5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
GENERAL REPAIRS									
Personal Services - Regular	DA5110.1	\$ 624,496	\$ 634,112	\$ 658,294	\$ 699,627	\$ 709,132	\$ 721,277	\$ 750,405	\$ 765,413
Personal Services - Overtime	DA5110.1.1	\$ 12,640	\$ 24,011	\$ 36,395	\$ 36,887	\$ 23,000	\$ 23,000	\$ 23,000	\$ 23,000
Equipment	DA5110.2	\$ 5,004	\$ 19,500	\$ 47,416	\$ 19,950		\$ 63,493	\$ 50,583	\$ 50,583
Contractual Expense	DA5110.4	\$ 461,102	\$ 350,298	\$ 454,517	\$ 464,253	\$ 513,488	\$ 513,488	\$ 513,488	\$ 513,488
Total		\$ 1,103,242	\$ 1,027,921	\$ 1,196,622	\$ 1,220,718	\$ 1,245,620	\$ 1,321,258	\$ 1,337,476	\$ 1,352,484
GARAGE									
Equipment	DA5132.2	\$ -	\$ 25,028	\$ -	\$ -	\$ 13,000	\$ 13,000	\$ 13,000	\$ 13,000
Contractual Expense	DA5132.4	\$ 8,933	\$ 12,583	\$ 14,438	\$ 17,565	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000
Total		\$ 8,933	\$ 37,611	\$ 14,438	\$ 17,565	\$ 31,000	\$ 31,000	\$ 31,000	\$ 31,000
EMPLOYEE BENEFITS									
State Retirement	DA9010.8	\$ 91,002	\$ 86,032	\$ 87,653	\$ 86,801	\$ 87,981	\$ 89,633	\$ 98,289	\$ 98,289
Social Security	DA9030.8	\$ 43,778	\$ 43,622	\$ 46,599	\$ 48,490	\$ 48,659	\$ 48,659	\$ 48,659	\$ 48,659
Worker's Compensation	DA9040.8	\$ 28,676	\$ 43,845	\$ 44,580	\$ 44,580	\$ 44,580	\$ 50,000	\$ 50,000	\$ 50,000
Unemployment Insurance	DA9050.8	\$ 298	\$ -	\$ -	\$ -	\$ 5,600	\$ 5,600	\$ 5,600	\$ 5,600
Disability Insurance	DA9055.8	\$ 711	\$ 954	\$ 373	\$ 289	\$ 900	\$ 900	\$ 900	\$ 900
Hospital & Medical Ins.	DA9060.8	\$ 161,000	\$ 202,587	\$ 168,161	\$ 199,954	\$ 219,545	\$ 230,053	\$ 239,255	\$ 248,825
Total		\$ 323,465	\$ 377,040	\$ 347,366	\$ 380,114	\$ 407,265	\$ 424,845	\$ 442,703	\$ 452,273
DEBT SERVICE PRINCIPAL									
Bond Principal	DA9710.6	\$ 172,290	\$ 177,290	\$ 177,290	\$ 182,290	\$ -	\$ -	\$ -	\$ -
Capital Note Principal	DA9740.6	\$ 50,187	\$ 51,428	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
BAN Principal - Brookside Ave.	DA5120.4	\$ 250,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
DEBT SERVICE INTEREST									
Bond Interest	DA9710.7	\$ 33,827	\$ 29,666	\$ 26,751	\$ 22,200	\$ -	\$ -	\$ -	\$ -
Capital Note Interest	DA9740.7	\$ 2,510	\$ 1,269	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
BAN Interest - Brookside Ave.	DA5120.4	\$ 2,187	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total		\$ 511,001	\$ 259,653	\$ 204,041	\$ 204,490	\$ -	\$ -	\$ -	\$ -
INTERFUND TRANSFER									
Interfund Transfer	DA9901.9	\$ 24,000	\$ 24,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Reserve (Drainage Maintenance)	DA0885.3	0	7,000	7,000	5,350	7,000	20,000	20,000	20,000
TOTAL HIGHWAY APPROPRIATION		\$ 2,002,509	\$ 1,764,610	\$ 1,800,852	\$ 1,894,059	\$ 1,759,885	\$ 1,868,863	\$ 1,905,809	\$ 1,933,372
HIGHWAY FUND ESTIMATED REVENUES									
LOCAL SOURCES									
Interest and Earnings	DA2401	\$ 48,893	\$ 50,000	\$ 27,639	\$ 747	\$ 19,700	\$ 1,000	\$ 1,000	\$ 1,000
Street Opening Permits	DA2560	\$ 6,300	\$ 2,400	\$ 7,875	\$ 10,425	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000
Sale Of Equipment	DA2665	\$ 872	\$ -	\$ 650	\$ -	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000
Insurance Recoveries	DA2680	\$ 2,000	\$ -	\$ 316	\$ -	\$ 2,000	\$ 1,000	\$ 1,000	\$ 1,000
Total		\$ 57,865	\$ 52,400	\$ 36,480	\$ 11,172	\$ 29,700	\$ 10,000	\$ 10,000	\$ 10,000
AID REVENUE									
Consolidated Highway	DA3501	\$ 125,849	\$ 144,476	\$ 144,544	\$ 117,724	\$ 120,000	\$ 120,000	\$ 120,000	\$ 120,000
State Emergency Aid	DA3960								
State Revolving Fund Subsidy	DA3989	\$ 1,560	\$ 2,218	\$ 1,345	\$ 453	\$ -	\$ -	\$ -	\$ -
Federal Emergency Aid	DA4960	\$ -	\$ -	\$ 37,916	\$ -	\$ -	\$ -	\$ -	\$ -
Total		\$ 127,409	\$ 146,694	\$ 183,805	\$ 118,177	\$ 120,000	\$ 120,000	\$ 138,477	\$ 138,477
TOTAL HIGHWAY FUND ESTIMATED		\$ 185,274	\$ 199,094	\$ 220,285	\$ 129,349	\$ 149,700	\$ 130,000	\$ 148,477	\$ 148,477