

AASHTO PRACTITIONER'S HANDBOOK

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DEVELOPING AND IMPLEMENTING A STORMWATER MANAGEMENT PROGRAM IN A TRANSPORTATION AGENCY

State departments of transportation (DOTs) face increasing pressure to reduce pollution in their stormwater discharges. This handbook provides recommendations for developing and implementing an effective stormwater management program to help comply with National Pollutant Discharge Elimination System (NPDES) regulations.

Issues covered in this handbook include:

- Development and implementation of a stormwater management program;
- Clean Water Act (CWA) and the NPDES program;
- State and local stormwater regulations;
- Conducting a Program Effectiveness Assessment (PEA);
- Developing a stormwater management plan (SWMP);
- Public education and outreach;
- Construction site stormwater compliance;
- Integrating Best Management Practices (BMPs) into transportation project delivery;
- Roadway maintenance stormwater practices and NPDES compliance;
- Total Maximum Daily Loads (TMDLs) and other special requirements; and
- Important stormwater management terms.

The Center for Environmental Excellence by AASHTO produces the Practitioners' Handbooks. The handbooks provide practical advice on a range of environmental issues that arise during the planning, development, and operation of transportation projects.

Each handbook is developed by the Center in cooperation with an advisory group that includes representatives of the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), state DOTs, and other agencies as appropriate.

The handbooks are primarily intended for use by program and project managers and others who are responsible for coordinating compliance with a wide range of regulatory requirements. With their needs in mind, each handbook includes:

- A background briefing;
- Key issues to consider; and
- Practical tips for achieving compliance.

In addition, key regulations, guidance materials, and sample documents for each handbook are posted on the Center's web site at <http://environment.transportation.org>



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Overview



The purpose of this handbook is to assist transportation agencies in developing and/or implementing a stormwater management program that satisfies the requirements of the Clean Water Act¹ (CWA). For agencies that already have a functioning stormwater management program, this handbook provides useful tips and transportation specific references to assist program implementation.

Throughout this handbook, the terms “stormwater management program” and “stormwater management plan” (SWMP) are used. The term “stormwater management program” refers to the entire program implemented by a transportation agency to comply with their National Pollutant Discharge Elimination System² (NPDES) permit(s) for stormwater discharges. The term “SWMP” refers to a specific document that describes the framework for implementation of the stormwater management program for the agency.

The NPDES program was developed to implement the requirements of the CWA. The 1987 amendments to the CWA required that municipal separate storm sewer systems³ (MS4s), including those owned by transportation agencies (i.e., DOTs and transit agencies), obtain stormwater permits, effectively designating them as “point source” discharges.

The U.S. EPA implemented the NPDES program in two phases depending on the population of the municipality. Transportation agencies are considered a “municipal” permittee even though a population metric does not apply. Accordingly, all transportation agencies are covered by either a Phase I or a Phase II NPDES permit for stormwater discharge. Many transportation agencies are entering into a fourth round of Phase I permits that are issued on a five-year cycle; however, some transportation agencies have entered the permitting system relatively recently under Phase II of the program. The agency may be covered by multiple Phase I or Phase II permits by geographic region, either individually or as a co-permittee with other agencies or municipalities, and the requirements in each permit may vary.

Compliance with stormwater NPDES permits is a requirement under federal law, but a well-designed stormwater management program also benefits a state highway system by supporting sustainability goals and reducing infrastructure costs:

- Use of vegetated conveyances can reduce capital as well as operation and maintenance (O&M) costs.
- Open-graded friction course overlays may improve water quality and safety; future permeable pavement systems could enhance these benefits further.
- Programs such as sweeping and trash pickup provide program benefits for safety and aesthetics, as well as NPDES program compliance.
- Reduction of pesticide use reduces chemical, training, and personnel costs.

Implementation of a stormwater management program will also have substantial environmental benefits. The National Research Council notes that urban runoff is one of the primary sources of pollution in surface waters⁴. Environmental benefits of highway stormwater quality enhancement include:

- Maintenance of beneficial uses of receiving waters;
- Maintenance or improvement of riparian habitat;
- Aesthetic improvements of waterways by reducing trash;

1 Clean Water Act: <http://www.epa.gov/lawsregs/laws/cwa.html>.

2 <http://www.epa.gov/npdes>.

3 <http://www.epa.gov/npdes/stormwater/municipal>.

4 National Research Council. *Urban Stormwater Management in the United States*. October 15, 2008, Washington, DC. pp. 18–20.

- Recharge of local aquifers through increased infiltration; and
- Reduced flood potential in conveyances.

The U.S. National Environmental Policy Act (NEPA) of 1969 declared a national policy to "create and maintain conditions under which [humans] and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."⁵ Stormwater quality programs not only include the environmental benefits noted above, but are also a part of a program for sustainability through water conservation, habitat preservation, and preservation of surface water hydrology.

Stormwater compliance programs may also have implications for the impacts of climate change. U.S. EPA climate models predict that the average temperature at the Earth's surface could increase from 3.2 to 7.2°F above 1990 levels by the end of this century. The temperature increase could cause changes in precipitation patterns.⁶ Highways that incorporate stormwater quality features for conveyance may be better able to adapt to climate change. For example, vegetated channels may be able to convey surface flows while surcharged, with less flooding on adjacent facilities, and they can be modified with less cost compared to underground and open channel systems with rigid linings.

This handbook provides information on the NPDES program and the basic requirements for creating a stormwater management program for a state DOT to comply with federal regulations. The federal regulations require six minimum measures in the development of a stormwater management program. The six minimum measures are shown in Table 1. Many states have additional clean water regulations beyond the requirements described here; however, the basic framework provided will support and be consistent with state-specific requirements. Stormwater regulations are state-specific, and it is important to understand local requirements when developing and implementing an agency stormwater management program. This handbook also provides information to assist in implementing a SWMP if one has already been developed.

TABLE 1. SIX MINIMUM MEASURES WHEN CREATING A STORMWATER MANAGEMENT PROGRAM

1. Public Education and Outreach	3. Illicit Discharge Detection and Elimination	5. Post Construction Runoff Control
2. Public Participation/Involvement	4. Construction Site Runoff Control	6. Pollution Prevention/Good Housekeeping Practices

⁵ <http://www.epa.gov/sustainability/basicinfo.htm>.

⁶ <http://www.epa.gov/climatechange/basicinfo.html>.

Background Briefing

Clean Water Act

The Clean Water Act (formerly the Federal Water Pollution Control Act) was instituted by the U.S. EPA in 1972 to protect the nation's waters. As the primary federal law governing water pollution, the CWA employs a number of regulatory and non-regulatory tools to reduce discharge of pollutants into waters of the United States, thereby ensuring these waters are habitable for plants and wildlife and are safe for human activities. Water protection under the CWA covers point sources, such as industrial, municipal, and some agricultural facilities, but excludes nonpoint sources such as forestry and return flows from agriculture. The CWA uses a water quality approach with technology-based standards to protect receiving water quality.

Federal environmental regulations based on the CWA have evolved to require the control of pollutants from MS4s, construction sites, and industrial activities. Discharges from such sources were brought under the NPDES permit process by the 1987 CWA amendments and the subsequent 1990 promulgation of stormwater regulations by the U.S. EPA.

Under the federal stormwater regulations, a transportation agency's properties, facilities, and activities fall under the jurisdiction of NPDES stormwater regulations for two primary reasons:

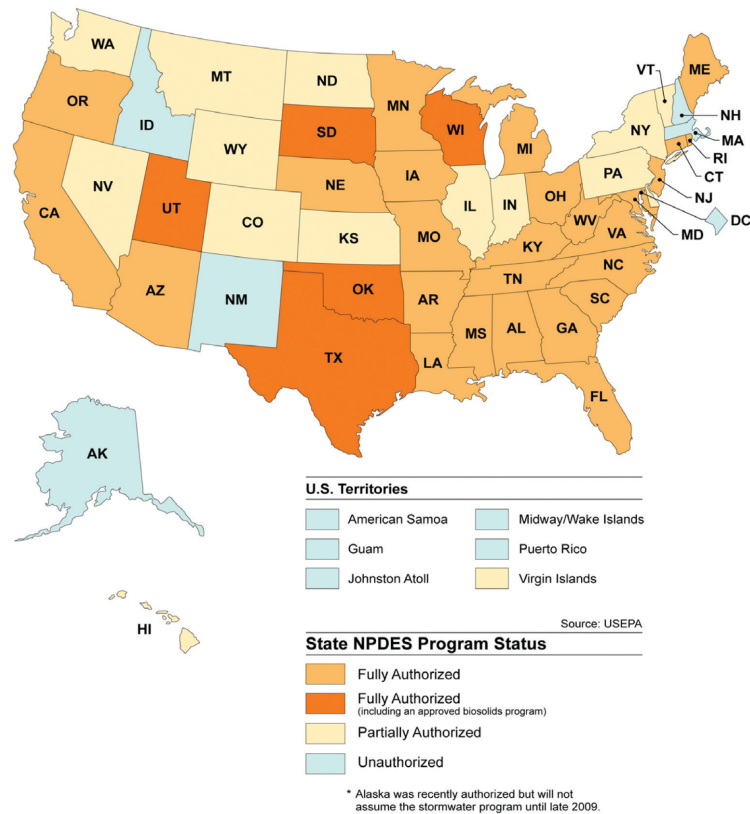
- Highways, highway-related properties, transit facilities, and activities are served by storm drain systems, which are often connected to, and are considered comparable to, urban MS4s covered explicitly in the federal stormwater regulations.
- Construction of highways and transit and related facilities often results in soil disturbance of areas greater than one acre, for which specific requirements are prescribed by the federal stormwater regulations.

The Code of Federal Regulations⁷ (CFR), 40 CFR 122.26(a)(iii) and (iv), requires that NPDES stormwater permits be issued for discharges from large, medium, and designated small MS4s. The regulations define the term "MS4" to mean "a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) owned or operated by a state, city, town, borough, county." Each DOT, as the owner and operator of an MS4, is subject to an NPDES MS4 permit in those areas as specified under federal regulation.

Delegated Authority

Most states are authorized to some degree to implement the NPDES program under "delegated authority" from the U.S. EPA. These states have authority to regulate surface water runoff that may affect receiving water quality. Figure 1 shows the status of states and territories to implement the program.

⁷ Code of Federal Regulations: <http://ecfr.gpoaccess.gov/>.



Source: U.S. EPA

Figure 1. State NPDES Program Status

Environmental Management Systems

There is a continuing emphasis on transportation agencies to practice environmental stewardship in all facets of their operations—from planning through routine maintenance. Environmental stewardship means making decisions and conducting operations in a manner to protect and improve the environment. An Environmental Management System (EMS) directly supports environmental stewardship by providing the means to routinely and consistently consider (not just on a project-by-project basis) environmental effects and requirements in transportation decision-making as well as day-to-day activities. Elements of an EMS have been developed by AASHTO and other government and private-sector organizations. The elements of an EMS are similar to a stormwater management program, and its elements can be integrated into an agency's EMS if one is in place. The AASHTO Practitioner's Handbook #8, "Developing and Implementing an Environmental Management System in a State Department of Transportation"⁸ gives an overview of EMS systems.

8 AASHTO Practitioner's Handbook #8 is available at http://environment.transportation.org/center/products_programs/practitioners_handbooks.aspx.

NPDES Program Requirements

The Clean Water Act amendments of 1987 required the control of pollution in stormwater. The U.S. EPA developed the NPDES permit system (in part) to regulate stormwater quality from publicly owned storm drain systems. The NPDES permit system was implemented in two Phases, I and II, generally for municipalities that serve greater than and less than 100,000 people respectively. Transportation agencies were generally designated as “Phase I” entities and were required to apply for and receive an NPDES permit for stormwater discharges from their storm drain systems; however, some agencies were designated “Phase II” entities.

Phase I stormwater management programs are generally more mature and sophisticated than Phase II programs and may have additional requirements, since they were permitted several years prior to the Phase II programs. Whether the agency operates under a Phase I or Phase II permit is becoming less important, and program requirements between the two phases are proceeding towards parity. Stormwater NPDES permits require the development of a SWMP or similar type of document describing how the permittee will comply with CWA regulations. NPDES permits are reissued every five years. Permitting agencies are expected to notify the public of proposed permits and include a public comment period during the permit reissuance process.

State Regulations

Some states have enacted environmental laws that regulate stormwater. State law cannot preempt federal law unless the state law is more environmentally protective. In addition, state law may regulate waters that are not federally regulated, such as isolated wetlands. It is important to understand state law as it pertains to stormwater quality regulation and make sure that the state’s stormwater management program meets applicable requirements. The U.S. EPA retains authority for the regulation of tribal lands relative to NPDES Permits in most states but there are exceptions, such as the state of Maine, which has NPDES authority over two tribes. A list of state environmental links for further information can be found on the AASHTO website.

Local Regulations

NPDES stormwater permits often require transportation agencies to coordinate with adjacent NPDES permittees (generally municipalities) to enhance their programs’ effectiveness and ensure that stormwater quality approaches are compatible. There is no requirement for transportation agencies to adopt or adhere to local (municipal) water quality standards, but agencies working in partnership with municipalities can leverage program elements and funds to increase program effectiveness compared to independent program implementation. Examples are provided under Practical Tip #1, Public Education and Outreach.

NPDES Program Elements

Stormwater management programs developed to comply with NPDES requirements generally include some combination of the following elements:

- **Management and Organization.** Addresses legal authority (i.e., airspace leases, permit activities in the agency right-of-way), access control, budget, and departmental policy related to stormwater quality management. This element also describes the organizational structure of the agency and the functional structure and responsibilities for stormwater management within the organization.
- **Monitoring and Discharge Characterization Program.** A program consisting of planned activities to assess the quality of stormwater discharging from roads, highways, and other transit facilities. This element also provides information for runoff water quality prioritization and improvement. This includes identifying outfalls and characterizing their discharges.
- **Project Planning and Design.** Best Management Practices (BMPs) and other stormwater management program elements are incorporated into transportation projects during the early planning and design phases of the project.
- **Construction.** This element describes compliance with Stormwater Pollution Prevention Plan (SWPPP) development and approval responsibilities, construction notifications, inspection of construction projects, and any other technical requirements of the state or federal construction general permit.

- **Roadway Maintenance Activities.** These activities include roadway and transit facility maintenance activities that affect stormwater, the BMPs used to prevent and control pollution and routine surveillance and inspection activities to ensure water quality is protected.
- **Facility Operations.** This includes the pollution prevention techniques, maintenance activities, and other SWPPP elements at the agency's maintenance facilities (such as material storage areas and maintenance yards).
- **Non-Departmental Activities.** These activities include stormwater compliance of non-departmental activities, including construction activities by private entities that encroach on the agency's property, third-party facility operations on leased parcels, and other third-party activities.
- **Non-Stormwater Activities/Discharges.** This includes discharges other than stormwater as defined by the NPDES permit including accidental spills, illegal connections, illegal dumping, and authorized discharges.
- **Training.** This element includes the training program and plans for training of staff and contractors.
- **Public Education and Participation.** This comprises the framework and future plans to communicate with, involve in the program, and inform the public about stormwater protection.
- **Location-Specific Activities.** Location-specific activities are undertaken to address regional stormwater requirements including involvement with the implementation of Total Maximum Daily Loads (TMDLs).
- **Program Evaluation.** Evaluations are conducted for compliance with all the stormwater management program requirements, including construction and maintenance field activities.
- **Measurable Objectives.** This includes the objectives, activities, and implementation tasks that are to be performed to achieve stated stormwater management program goals.
- **Reporting.** Transportation agencies report on applicable elements of the SWMP, including the annual report, and possibly work plans, proposed SWMP modifications, and noncompliance incidents.

The U.S. EPA supports public and private organizations joining forces to create multi-jurisdictional partnerships to focus on surface water pollution on a watershed basis. Objectives of the watershed approach are restoration, maintenance, and protection of water resources in the United States. Transportation agency stormwater management programs may include an element to develop partnerships with other agencies in common watersheds.

Program Effectiveness Assessment

Assessment of the stormwater management program effectiveness is generally done on an annual basis for each of the NPDES program elements. The U.S. EPA does not have strict guidelines for effectiveness assessment but promotes the incorporation of measurable goals to assess implementation progress and effectiveness. The California Stormwater Quality Association (CASQA) has developed a formalized method of stormwater management program effectiveness assessment. A collection of tools is applied to each program element using a tiered assessment framework that promotes evaluation on progressively higher "outcome" levels as the stormwater management program matures. This results in an adaptive assessment method that can be used to continually improve program performance.

The effectiveness assessment measures the programmatic and/or environmental impacts of the stormwater management program, and it is conducted to determine if the various programs and/or activities are resulting in the desired outcomes. The assessment identifies the outcome level(s) achieved, the outcomes level(s) that may be achieved in the future, and beneficial program modifications.

As illustrated in Figure 2, CASQA defines six outcome levels for the effectiveness assessment. The outcome levels help to categorize and describe the desired results or goals of the program. The ultimate goal of the stormwater management program is the protection and improvement of water quality, which is measured with outcome Levels 5 and 6. In general, Levels 1, 2, 3, and 4 can be considered Implementation Outcomes, and Levels 5 and 6 can be considered Water Quality Outcomes.



Figure 2. Program Effectiveness Assessment⁹

The outcome levels assist in categorizing and gauging the performance of the stormwater management program. Important points to consider about effectiveness assessments include:

- The ability of a stormwater management program to assess an outcome level tends to become progressively more difficult as one moves up the pyramid (e.g., Level 4 is more difficult to assess than Level 2). This is primarily because the upper levels of the pyramid assess the impact of the program on water quality, which requires a much more robust dataset over an extended period.
- Levels 1 through 3 are typically assessed using program management data, whereas Levels 4 through 6 are assessed using physical and/or water quality monitoring data. Levels 1 through 3 are more appropriate for program elements such as management and organization, training, public participation, and education.
- Each major NPDES program element (e.g., illicit discharge identification and elimination, public education, etc.) can be assessed at one or more outcome levels based on the data and information available.
- Outcome Levels 5 and 6 are used to assess the effectiveness of the overall stormwater management program; however, it is difficult to correlate the implementation of the program to changes that may be observed in runoff or receiving water quality. Therefore, these types of assessments are conducted less frequently, and they require a more robust dataset than Outcome Levels 1–4. The stormwater contribution of highways and transit related facilities within a given watershed is difficult to assess and instead may need to be evaluated in the context of other stormwater contributions within the watershed.

Stormwater Management Plan

A Stormwater Management Plan (SWMP) describes the DOT's program and addresses stormwater pollution control related to DOT activities, including planning, design, construction, and operation and maintenance of roadways and facilities. For municipal-type discharges, the SWMP provisions control pollutants to the maximum extent practicable (MEP) as required by the CWA. MEP is generally considered to be based on factors such as technical feasibility and related costs to achieve measurable environmental benefits. The SWMP is designed to include an iterative process of use, evaluation, and modification/retrofitting of BMPs to provide continuing progress toward protecting water quality and achieving compliance with receiving water standards. It is good practice to prepare the SWMP in collaboration with the U.S. EPA and/or the state regulatory agency.

⁹ California Stormwater Quality Association, 2007.