A Developer's Guide to Post-construction Stormwater Regulation

NAHB National Association of Home Builders | AECOM

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Disclaimer: This guide is not intended to be a substitute for legal or other professional advice. Much of the information is applicable to a wide range of state permitting programs, but each authorized program has different requirements and procedures. Furthermore, regulations and permit requirements are subject to change, and builders and developers should consult their permitting authorities and legal counsel to ensure that they are complying with the most current requirements in their jurisdictions.

This report focuses Clean Water Act Section 402 Phase II stormwater permit requirements that impact builders and developers. Phase II permits generally apply to urban areas with populations under 100,000. Larger metro areas are regulated by Phase I permits. Information on individual permits for those major metropolitan areas may be found here: https://www.epa.gov/npdes/stormwater-discharges-municipal-sources.

Original data collection and research was performed by AECOM. Interpretation of data was performed by NAHB.

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Abbreviations

BMP	Best Management Practice
CWA	Clean Water Act
DCIA	Directly Connected Impervious Area
ELG	Effluent Limitation Guidelines
ESD	Environmental Site Design
HUC	Hydrologic Unit Code
IC	Impervious Cover
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollution Discharge Elimination System
RR	Runoff Reduction
SWMP	Stormwater Management Plan
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TN	Total Nitrogen
TSS	Total Suspended Solids
WQv	Water Quality Volume

Key Terms

Post-construction Control:
Site design methods, physical controls and ongoing activities intended to maintain permanent stormwater control over the life of a property's use.

Municipal Separate Storm Sewer System (MS4):
A conveyance or system of conveyances owned by a state, city, town, village or other public entity that discharges stormwater into waters of the United States.

National Pollutant Discharge Elimination System (NPDES):
Authorized under the Clean Water Act, the NPDES permit program regulates point source discharges into waters of the United States.

Phase I Regulations:
Issued in 1990, these EPA regulations required permit coverage for discharges associated with "large" (population greater than 250,000) and "medium" MS4s (population between 100,000 and 250,000), among others.

Phase II Regulations:
Issued in 1999, these EPA rules require regulated small MS4s in urbanized areas to obtain NPDES permit coverage for stormwater discharges.

Executive Summary

Stormwater regulations are changing quickly. Builders and developers must understand both the minimum requirements established by federal rules as well as the different approaches used by states to implement them. This report focuses on **post-construction** stormwater control requirements. Post-construction controls include: site design methods, physical controls and ongoing activities intended to permanently manage a site's stormwater over the life of the property's use.

Between 2015 and 2017, Aecom and the National Association of Home Builders (NAHB) conducted research to identify the different approaches that states use to regulate post-construction stormwater runoff. This study is intended to help NAHB's more than 700 state and local home builder associations have a stronger voice in stormwater program development and implementation.

Through a desktop literature review of state Phase II general stormwater permits and other regulatory documents, as well as interviews with NPDES permitting staff in 20 states, this research tracks the distribution of different standard approaches across the US. In addition, it breaks down state-by-state data for five key post-construction program elements that directly affect the housing and development industries.

Now, more than ever, resource constraints and technical challenges mean that communities need innovative, inexpensive ways to provide clear, flexible options for managing stormwater. If post-construction regulations are not designed and implemented in a thoughtful way, new standards can decrease the number of available pollutant-reduction options, increase costs, delay projects, result in poorly designed or maintained features, or simply occupy valuable space that could be used for housing or other community amenities. Alternatively, post-construction approaches such as green infrastructure, if implemented well, can seamlessly integrate into existing requirements, build value and achieve multiple community and environmental benefits.

Stormwater affects public health and safety in two ways: quantity and quality. Higher quantity of water moving across impervious surfaces can increase localized flooding and scour small streams. Pollutants like dirt, oil, bacteria and trash are also carried by stormwater into lakes and rivers, in some cases degrading fishing and swimming uses.

Key Findings:

- **State standards are getting stricter; variety and complexity is increasing**.
  States are using existing Clean Water Act authority to tighten post-construction stormwater control requirements. While **18** states employ narrative (non-numeric) approaches to post-construction control; **11** states use a treatment-only approach; **8** states (and D.C.) use a retention-only approach; and **13** states require a combination of treatment and retention. The New England and Mid-Atlantic regions (EPA Regions 1, 2, 3) have become the strictest, with all **14** states using numeric limits as the basis for their state programs.

- **Stormwater limits are increasingly being housed in state stormwater manuals or rules, rather than Phase II permits.**
  This poses important implications for how builders participate in the regulatory process. Changes to state design manuals, for example, may not include a formal notice-and-comment period so landowners may not know that regulators are considering changes.

- **States with narrative standards are particularly vulnerable to change.**
  Although the use of narrative standards remains viable, it is expected that states will respond to recent revision of EPA's small MS4s regulations by putting extra effort into ensuring that non-numeric provisions are clear, enforceable and measurable in future permit terms. The states relying on non-numeric post-construction standards and operating under expired permits (New Mexico, Nebraska, South Dakota, Wyoming and Hawaii) are particularly vulnerable to change.

But it's not just the approach each state takes that matters. How states direct MS4s to meet standards and how these standards are translated into on-the-ground requirements can have community-wide implications. Recognizing this, we also studied five commonly cited program elements. If and how these supporting components are incorporated into an MS4's permit can significantly affect how builders and developers design, construct and implement stormwater controls on private property.

Top 5 Post-Construction Program Elements Affecting Builders and Developers

1. Maintenance Responsibility

Nearly **60%** of Phase II general permits require MS4s to assign long-term maintenance responsibility for post-construction stormwater controls.

2. Flood Control

Just over **50%** of Phase II general permits mandate consideration of flood or drainage control in concert with stormwater management, but few include language describing how water quality controls are to interact with detention or drainage regulations.

3. Green Infrastructure & LID Requirements

An increasing number of states require Low Impact Development (LID) or the use of green infrastructure techniques to control stormwater runoff. **50%** of Phase II general permits contain some type of mandatory language concerning these practices.

4. Off-site Compliance & Fee-in-Lieu Options

These programs provide developers much-needed flexibility on projects where they are unable to fully implement stormwater controls on-site due to poor site conditions. Unfortunately, these programs are only mandated in **7%** of state Phase II general permits.

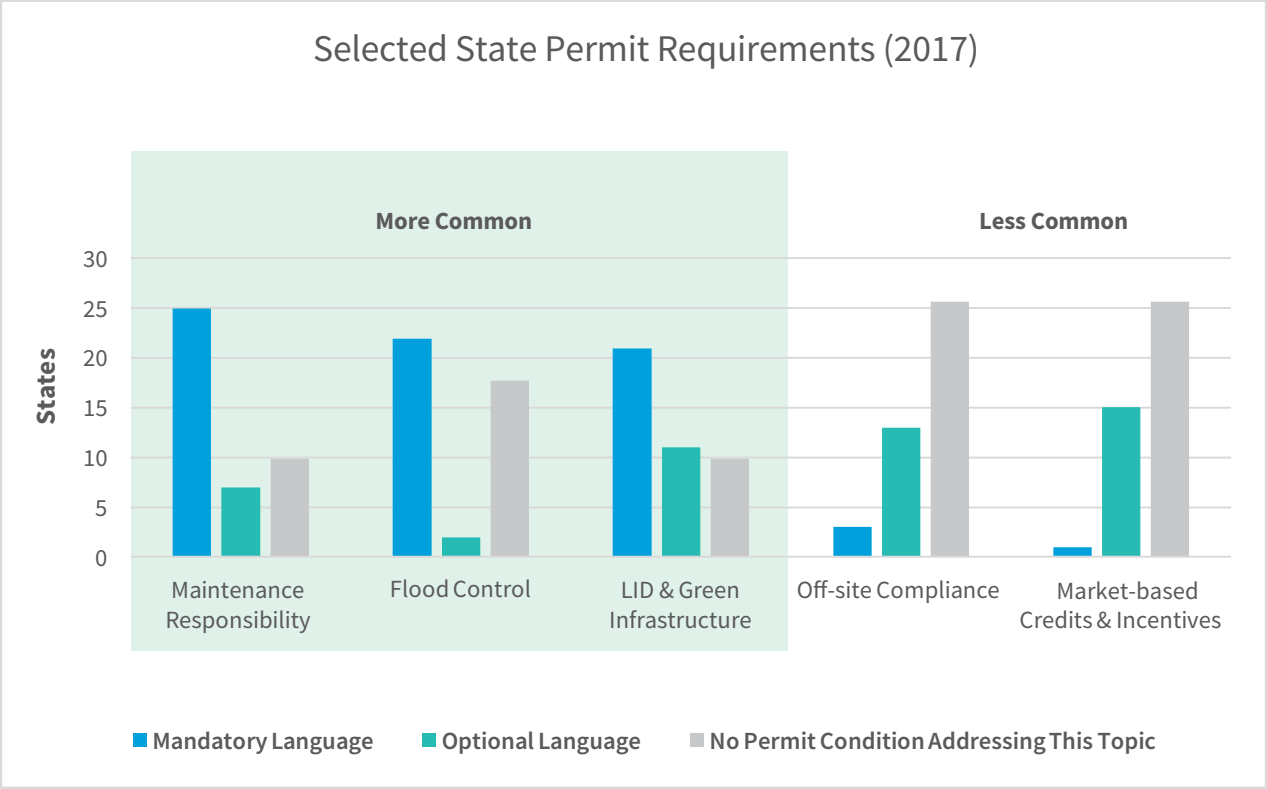
5. Market-based Mechanisms & Incentives

Trading and development incentive programs use the power of the market to encourage performance above and beyond existing requirements, entice construction of community amenities, or lower the costs of stormwater management for difficult sites. While **48%** of the state Phase II programs surveyed provide language on adopting incentives for developers, only **2%** mandate their availability.

Off-site compliance options and market-based incentives can help make stormwater requirements workable, especially for difficult sites with poor soils or limited space. However, these programs are not often mandated in CWA permits.

Figure 1. Phase II General Permit Language

Data collected for this review was limited to Phase II general permit language. Other state or local rules may impose additional requirements. Tally does not include Maryland and Indiana because they defer to state rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits.



Installing permeable pavers can reduce impervious surface footprints in tight urban areas.

Alisha Goldstein

There is a clear broadening of post-construction requirements mandating the use of green features, flood control considerations, and binding maintenance responsibilities to ensure controls perform consistently over time. Perhaps more importantly, states and other NPDES permitting authorities are beginning to recognize the challenges of implementing post-construction stormwater controls over the full range of site conditions and are requiring that programs include much-needed support and flexibility to accommodate projects that cannot fully implement the requirements on-site.

Although some states have taken the leap and adopted robust off-site compliance and market-based trading or development incentive programs, their availbility may not be keeping up with demand in the field. The limited appearance of these so called "supporting" elements in state programs indicates that in some cases, states may be adopting stricter post-construction approaches without including mechanisms to make these approaches workable. In areas where stricter retention standards are adopted, for example, both strong off-site compliance options and incentive-based opportunities, like volume credit-trading, may be necessary to curb ballooning costs on some sites.

Clearly, reviewing and understanding the range and scope of current state post-construction programs is useful, but the unfortunate fact is that there is no "one-size-fits-all" solution. Because states and localities have other responsibilities in addition to controlling their stormwater runoff, determining how to do so becomes a balancing act between competing local needs priorities, and resources.

While 76% of Phase II general permits either require or encourage green infrastructure, only 7% of states mandate the availability of off-site options for sites that are not conducive to these practices.

When seeking to identify workable post-construction program options, developers should take the following considerations into account.

1. Ease and Cost of Implementation

Any successful program must be designed to be run using allocated resources and staff. Full consideration must also be given to the range of program elements and implementation options, including program structure, roles and responsibilities, how the program is implemented in the field and how compliance is demonstrated and/or ensured. Equally important is the ability of stakeholders and the public to understand the program and how its success is measured. For example, States adopting a combination of treatment and retention approaches present different challenges for compliance compared to states adopting a standard focused on retention or treatment alone. In many cases, ease of implementation may not have as much to do with the underlying standard itself, but quality and flexibility of compliance assistance materials, manuals, and sizing tools.

2. Site Factors

Runoff quantity and quality and the ability to successfully control them are governed by the varying natural and manmade site characteristics of each property and project. As a result, selecting a state control approach is a fairly complex undertaking that must consider the realities of the state's landscape, stormwater runoff potential, and pollutant sources. Prior land use, level of impervious surface coverage and soil compaction can all impact how much runoff can be retained on-site. Similarly, topography, soils and rainfall patterns can influence runoff flow and pollutant concentration. All of these conditions can also impact the ability of BMPs to properly control stormwater.

3. Consistency versus Flexibility

Some states choose to identify each step that must be taken towards control of stormwater on residential sites, whiles others prefer to establish a framework and allow municipalities to tailor programs to their specific needs. From an administrative standpoint, it may appear easier to run a program that requires all the municipalities in a state to do the same things, but given differing conditions, such an approach may not make sense because it may require certain MS4s to conduct activities that are unnecessary or inefficient. Narrative approaches tend to give municipalities wide discretion to implement post-construction stormwater programs that take into account local terrain, climate, soils and other factors unique to their cities. Treatment-only, retention-only, and to some extent combined treatment and retention approaches tend to provide much more consistency across an entire state in terms of results, but can still be tailored to take on more flexibility if the state desires to do so.

4. Efficacy in Achieving Water Quality Benefits

NPDES permits and associated standards are designed to improve water quality, but if they are not planned and implemented well, their effectiveness can be significantly strained. Typically, local geography and land development trends are the biggest influences over which post-construction approaches will actually achieve optimal pollutant removal. While the narrative approach is the most flexible and can be the easiest to implement, it may not lead to measurable differences in the quality of post-construction stormwater runoff unless the BMPs are tracked and pollutant reductions accounted for. Retention-only and treatment and retention approaches can provide great water quality benefits due to the ability of retention-based features to actually capture, infiltrate and treat flows within site boundaries and to do so relatively naturally.

Selecting a state post-construction stormwater control approach is obviously not an easy task. Through clear communication and priority-setting up front, however, strong programs can be developed that work well for all parties and achieve water quality results.

Introduction

The increased prevalence, complexity and variation of numeric post-construction approaches has become a major concern for NAHB members.

EPA rules require regulated municipalities to develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment after construction activities are complete.[i]

Faced with shifting stormwater regulations, those in the building industry often ask:

> ***Why is this happening?*** *What mandates are driving my city or state to revise or adopt stricter stormwater regulations?*
>
> ***What does this mean for my development?*** *What types of post-construction controls will I have to install? Will this affect how many homes I can build?*
>
> ***What are my neighbors doing?*** *What standards are being adopted in neighboring states?*
>
> ***How can I make sure the requirements are workable?*** *How can I ensure that the regulations are flexible enough to reflect local needs and geographic constraints?*

This report provides a starting place to answer these questions. By becoming familiar with the current range of state programs to address post-construction stormwater, builders and developers will be better prepared to engage with regulators to arrive at effective solutions.

Study Organization

Section 1 provides an overview of the NPDES stormwater program and outlines minimum federal stormwater requirements that apply to states and municipalities.

Section 2 serves as a primer on the four most common approaches states use to control post-construction stormwater. These include:

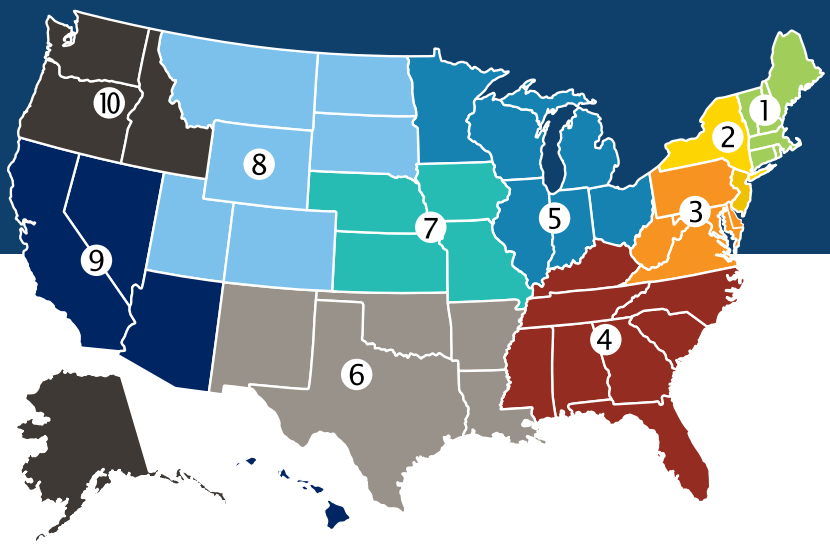
- **Narrative**
- **Treatment Only**
- **Retention Only**
- **Retention & Treatment**

In addition to explaining how each approach works, Section 2 shows where different standard types have been adopted across the country. It also provides a list of typical BMPs associated with each approach so that builders and developers can assess the feasibility of each in relation to the practices they will be likely required to use. The section concludes with general pros and cons of each approach from the perspective of builders and developers, followed by an overview of the importance of knowing what vehicle(s) the states are using to adopt their stormwater standards (e.g., state rules vs. NPDES permits).

Section 3 presents a state-by-state breakdown of five key post-construction program elements that directly affect how builders and developers design, construct and implement stormwater controls on private property. Program elements explored in this report include long-term maintenance responsibility, green infrastructure and LID, flood control-related requirements, off-site compliance options and market-based mechanisms.

Finally, Section 4 – *"Decision-Support Toolbox: Which Approach is Best for My State?"* contains a brief summary discussion and decision support tool that identifies considerations that should be taken

into account when seeking to establish a workable post-construction approach for your state or locality.



EPA Regions

- **Region 1**
- **Region 2** (Including Virgin Islands & Puerto Rico)
- **Region 3** (Including Washington DC)
- **Region 4**
- **Region 5**
- **Region 6**
- **Region 7**
- **Region 8**
- **Region 9** (Including Guam & American Samoa)
- **Region 10**

Methodology

State Phase II general permits were used as the primary dataset for this exercise due to their relative homogeneity in structure and the fact that most states rely on general permits for authorizing stormwater discharges from their Phase II cities. Although Phase I permits may seem to cover larger and growing population centers (Phase I applies to medium and large cities and certain counties with populations of 100,000 or more), they are generally issued as individual permits. Furthermore, they often contain highly complex stormwater control requirements that are tailored to the local sewer system conditions, which would render an extensive review both cost prohibitive and minimally applicable nationwide.

To categorize "statewide" approaches for post-construction standards, states were placed into one of four categories based on a desktop literature review of available state Phase II general permit documents, state legislation and binding state design manuals. To track which states have adopted any of the five supporting program elements, a Phase II general permit language review was conducted in April 2017 of the 42 states that use general permits for their Phase II MS4s. The District of Columbia's Phase I permit was included in all phases of this review due to its national significance.[ii]

Finally, Aecom drew on information gathered from interviews with water quality staff in 20 states as well as years of direct field experience to form a list of typical pros and cons associated with each regulatory approach in terms of how they affect the development community.

Why the Focus on EPA Regions?

Throughout this report, trends are broken down by EPA administrative region. EPA regions often differ greatly in the role they play in state programming for issues such as stormwater, with many actively involved in encouraging state action and others playing a simple oversight role. EPA regional administrators also have a great deal of discretion to advance specific policy and enforcement goals in their jurisdictions. Given this, some exhibit significant influence over the direction of not only each state, but the entire region – an outcome that is evident when looking at the distribution of different stormwater approaches across the U.S.

Further, the EPA regional grid, with some exceptions, is set along natural physical and geographic boundaries. As a result, the states within each region tend to have similar characteristics, and thus learn from one another and take similar approaches when they have been demonstrated to work. Drier regions such as Region 6 and Region 9 in the Southwest U.S., for example, specifically tailor their outreach and guidance to arid stormwater management concerns, some of which ultimately end up in the regulatory documents for the states in these regions.

A large retention pond in Seattle High Point Neighborhood provides multiple community benefits.

Nancy Arazan

1: Minimum Federal Stormwater Requirements

Builders and developers must understand baseline federal requirements and recognize the flexibility states have to implement them.

Stormwater runoff that comes from developed and urbanized areas can impact public health and safety in two ways. First, an increase in suspended solids, nutrients, metals and pathogens can threaten the health of aquatic organisms, wildlife and humans.[iii] Second, an increase in the **quantity** of runoff can alter or destroy aquatic habitat, change natural hydrologic patterns, and lead to local or downstream flooding.[iv]

Although cities have broad power and discretion to adopt local programs to address these issues, most are highly influenced by state and federal stormwater control requirements. Federal regulations actually affect builders twice – during active construction and in perpetuity after the construction project is complete (**post-construction**). This report focuses on post-construction regulations. The flow chart on page 14 illustrates how builders and developers are directly regulated by both construction stormwater regulations for erosion and sediment control during active construction, as well as the **Municipal Separate Storm Sewer Systems** (MS4) requirements to address post-construction stormwater runoff from new and re-development – a requirement established by the state or EPA for cities or sewer districts.

What is a NPDES MS4 Permit and Why is it Important?

The Clean Water Act's **National Pollution Discharge Elimination System** (NPDES) program requires most cities to obtain federal NPDES permit coverage because they discharge polluted stormwater via outfalls directly into rivers and streams. Recognizing the difficulty of regulating all the nation's municipalities at once, Congress allowed EPA to develop a phased permitting approach. Phase I would address certain types of "priority" stormwater discharges, while Phase II would address less significant discharges at a later date.

Issued in 1990, EPA's Phase I program regulates large MS4s (populations of greater than 250,000), and medium MS4s (populations between 100,000 and 250,000).[v] Most of the 750 or so Phase I cities are regulated by highly complex, locality-specific individual permits. In contrast, EPA's Phase II regulations, issued in 1999, allow most small MS4s in urbanized areas, as well as small MS4s outside urbanized areas that are designated by the permitting authority, to seek NPDES general permit coverage.[vi] Unlike the site-specific individual permits, general permits simply lay out a basic framework that must be followed, consistent with the permit eligibility and authorization provisions. There are over 6,500 Phase II MS4s. Both individual and general permits are issued by either the state or EPA where EPA is the permitting authority (Idaho, New Mexico, Massachusetts, New Hampshire, District of Columbia and Puerto Rico). Permits are typically valid for five years.

NPDES permits for regulated small MS4s require permittees to develop a Stormwater Management Plan, or SWMP, that describes control practices that will be used to minimize the discharge of pollutants from the storm sewer system.[vii] Importantly, as part of that SWMP, each Phase II MS4 must address six minimum control measures, including Public Education and Outreach, Public Involvement and Participation, Illicit Discharge Detection and Elimination, Construction Site Runoff Control, *Post-Construction Stormwater Management*, and Pollution Prevention/Good Housekeeping. MS4s must ensure that builders and developers control post-construction stormwater discharges leaving any new or redeveloped sites that are over one acre, and those under one acre within a larger subdivision or common plan of development. The regulatory text outlining requirements for Small MS4s is provided on page 16. As shown, even though Phase II general permits apply to municipalities, MS4s are required to pass along some of their responsibilities to builders and developers.

Since states have other authorities to regulate stormwater, it may be difficult to repeal an unworkable standard once adopted. Because of this, it is especially important for developers to engage with NPDES permit writers well before they propose any changes at the end of each five-year term.

How Do Federal Stormwater Rules Affect Builders?

ACTIVE CONSTRUCTION

EPA Construction Stormwater Regulations

STATES OR EPA
Issue construction general permits (CGPs)

BUILDERS
Must obtain coverage for sites disturbing >1 acre or <1 acre in a subdivision and implement plans to reduce sediment leaving sites during active construction.

PERMANENT OR POST-CONSTRUCTION

EPA Phase I, Phase II MS4 Stormwater Regulations

STATES OR EPA
Issue individual or general MS4 Permits

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)
Must produce Stormwater Management Plans (SWMPs) with criteria for *both* post-construction and active construction.

BUILDERS
Must comply with post-construction ordinances adopted by MS4s

**Cities and states often impose additional requirements.*

What are 'Clear, Specific and Measurable' Permit Requirements?

EPA revised its Small MS4 rules in 2016. Although these revisions did not change minimum requirements or standards, they contain important implications for state Phase II general permits, which now must be expressed in "clear, specific, and measurable" terms. EPA's preamble for this rule clarified that, "Permit requirements must be enforceable, and must provide a set of performance expectations and schedules that are readily understood by the permittee, the public and the permitting authority alike. For both types of general permits, requirements may be expressed in narrative or numeric form, as long as they are clear, specific, and measurable." [viii] EPA has since issued guidance to the states and EPA permitting authorities on how to write better MS4 permits using these guidelines (see page 25).

States and EPA permitting authorities are still responsible for establishing, at their discretion, what each MS4 must do to reduce the discharge of pollutants in stormwater runoff to the maximum extent practicable (MEP) to protect water quality and satisfy the requirements of the Clean Water Act.[ix] However, due to the new "clear, specific, and measurable" language, states that rely on narrative provisions may now feel pressure to place more emphasis on performance measures, benchmarks or schedules of implementation to comply with this language.

Does My State Have to Adopt Numeric Limits for all MS4s?

No. Permit conditions may still include a combination of narrative, numeric, or other types of requirements.[x] It is up to each state or EPA permitting authority to establish what is necessary for permit holders to do to reduce discharge of pollutants.

Program offices are required to re-issue NPDES general permits every five years. Contact your state or EPA NPDES program authority at least one year before your current permit expires to discuss possible stormwater program changes.

Federal Minimum Post-construction Requirements for Small MS4s:

"*The permit must identify the minimum elements and require the development, implementation, and enforcement of a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the small MS4. The permit must ensure that controls are in place that would prevent or minimize water quality impacts.*

At a minimum, the permit must require the permittee to:

(A) *Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for the community;*

(B) *Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State, Tribal or local law; and*

(C) *Ensure adequate long-term operation and maintenance of BMPs.*"

40 CFR 122.34(b)(5)

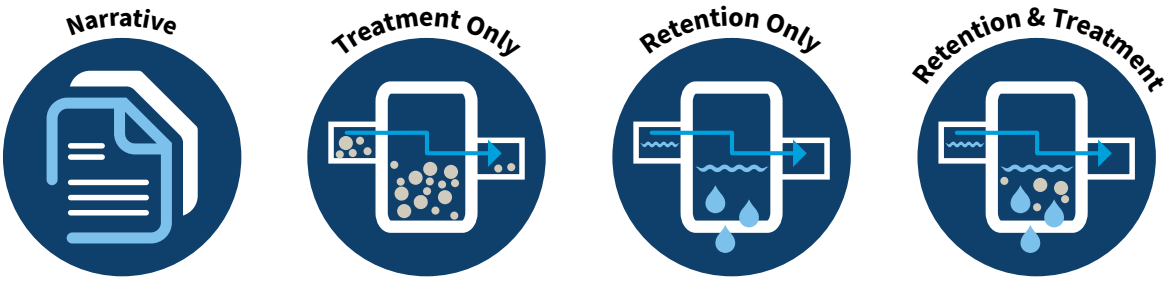
Increasingly, states are requiring retention-based practices such as tree wells, green roofs and permeable pavers that soak water into the ground before it reaches the storm drain.

2: Common Post-construction Control Approaches

The overall goal of post-construction stormwater management is to prevent pollutants from being discharged into local waterbodies.

Mainly, state programs either focus on design standards or performance measures aimed at achieving specific water *quality* or water *quantity* goals. While some programs require controls to remove a certain percentage or amount of pollutants from stormwater before it leaves a site, others require developments to manage a specific *quantity* of water through infiltration, evaporation, harvesting or reuse. Still others use a combination of quantity and quality standards. The reasoning varies: While some states may be motivated by the need to reduce the introduction of specific pollutants of concern, such as nitrogen or phosphorus, others may focus on reducing overland flow or flooding.

This section contains a primer on four general approaches states use to regulate post-construction flows. It also provides a survey of where these approaches are being adopted, typical BMPs associated with each approach, and general pros and cons from the perspective of builders and developers.



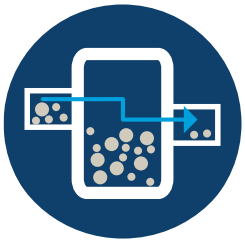
2.1 How Each Approach Works

Most states use one of four general approaches to regulate post-construction flows.

Narrative

Narrative or non-numeric post-construction regulations usually describe a general goal or set of goals ("minimize pollutants in stormwater" or "mimic pre-development hydrology") and provide wide discretion to reach that goal. Narrative requirements often require communities to ensure that specific tasks or BMPs are completed during a given permit term and may include specific direction on design requirements, schedules for implementation, maintenance, or frequency of municipal actions. In some cases, narrative BMPs may even include the *prohibition* of actions, such as ordinances banning certain types of residential fertilizer to reduce levels of nitrogen and phosphorus entering local streams. The narrative approach is the most basic of the four post-construction typologies and may call for both **structural** and **non-structural controls**. Language authorizing the narrative approach is housed in EPA's regulations.

Treatment Only



States adopting treatment approaches require developers to treat a specified amount of post-construction stormwater runoff, typically from a specific size storm. Treatment approaches usually require the installation of structural controls designed to improve the quality of the stormwater before it's discharged, such as wet ponds, **proprietary units** and sand filters. The specifics of the treatment approach can vary greatly from state to state, but most require a set of structural post-construction BMPs that, if designed and maintained correctly, will achieve the desired pollutant removal efficiency. As part of design criteria, each state specifies whether to size the BMP for a volume of runoff or runoff flow, depending on how the BMP functions. Some treatment-only standards require treatment of a specified volume of runoff. Others specify a percentage of pollutant removal. Still other jurisdictions adopt site-based pollutant load limits for specific land uses ("new residential development shall not exceed 0.41 lbs. total nitrogen per acre per year").

Retention Only

States using a retention approach require a certain amount of stormwater runoff to be retained on-site through infiltration, evapo-transpiration, capture or reuse. The volume of runoff required to be retained varies from state to state. Retention approaches typically include guidance on minimizing impervious areas, which decreases the volume of stormwater leaving the site and entering the MS4 system. States and MS4s adopting this approach may require infiltration-based BMPs, such as infiltration trenches and green roofs, and do not usually endorse proprietary units. EPA encourages the use of low impact development and green infrastructure to meet retention standards.

Retention & Treatment

The retention and treatment approach addresses both stormwater quality and quantity. It typically requires the installation of BMPs that individually or collectively treat *and* retain stormwater, such as rain gardens, filter strips and enhanced swales. States using this approach often require developers to demonstrate that the controls they install will ensure that post-development flows mimic pre-development levels, *as well as* treat stormwater runoff to remove a percentage of total suspended solids or other pollutant. Some states codify such standards as a **runoff reduction** limit accompanied by a treatment limit.

Structural Controls:

Stormwater control measures designed to achieve stormwater storage, such as wet ponds and extended-detention outlet structures; filtration, such as grassed swales, sand filters and filter strips; and infiltration, such as infiltration basins and infiltration trenches.

Non-structural Controls:

Stormwater control practices that may include policies and ordinances that direct growth to identified areas, protect sensitive areas, maintain and/or increase open space, credit leaf litter or fertilizer reduction, minimize impervious surfaces (e.g., reduce parking requirements), or provide education programs for developers.

Proprietary Units:

Manufactured/brand name stormwater treatment devices that utilize settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other technology to manage the impacts stormwater runoff. Many jurisdictions require local review and certification of proprietary practices before allowing them to be used to achieve compliance.

Runoff Reduction:

Strategies or performance standards that reduce the amount of stormwater runoff from small rain events through the use of practices that infiltrate, evapotranspire, or reuse stormwater. The Runoff Reduction Method promotes better site design as the first step in compliance with both stormwater quality and quantity requirements.

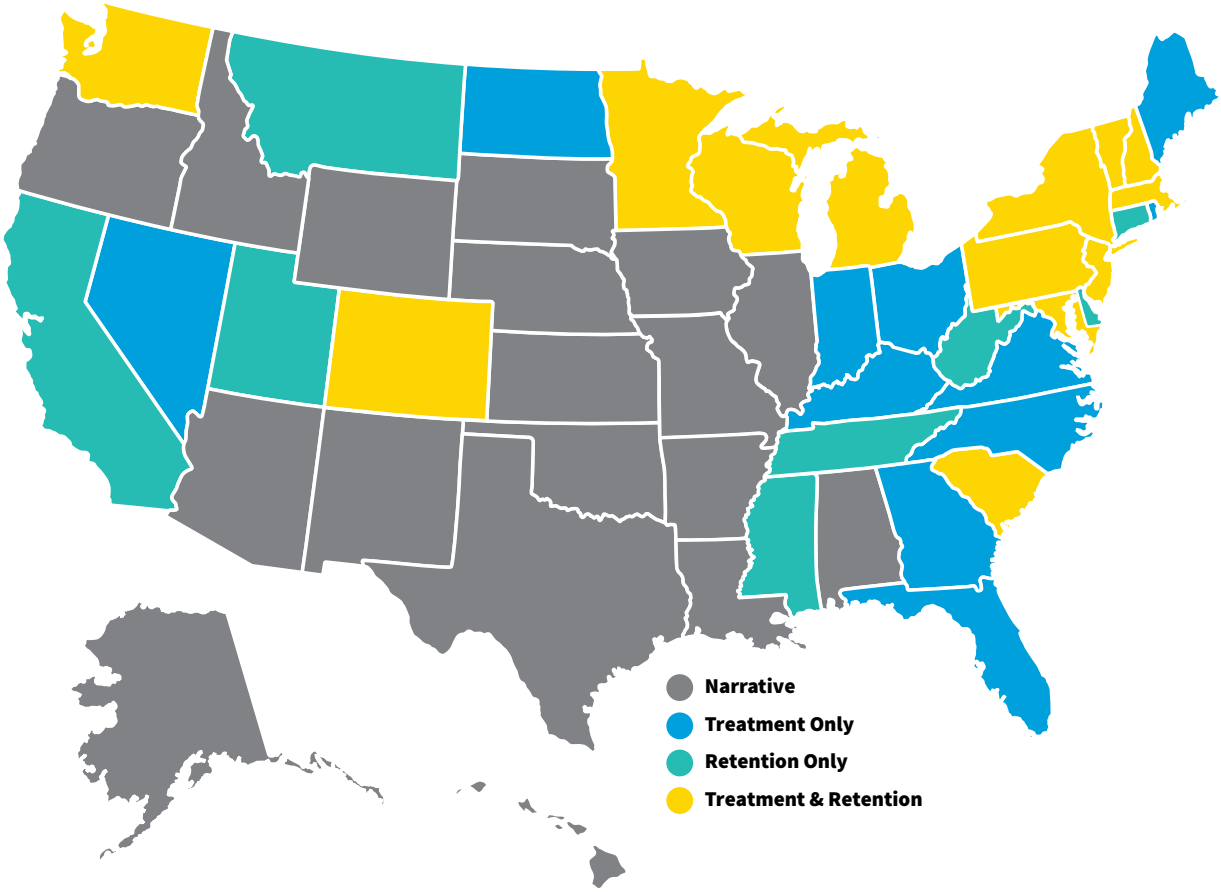
2.2 Distribution of Standards Across the U.S.

Complexity and variation in post-construction approaches are rising.

An April 2017 desktop literature review of all 50 states and the District of Columbia identified **18** states implementing a narrative approach, **11** states implementing a treatment-only approach, **8** states with a retention-only approach (plus the District of Columbia); and **13** states implementing a combined treatment and retention approach. Because treatment-only, retention-only, and combined treatment and retention approaches rely on meeting set values for pollutant reduction or flow control, they also are collectively referred to as numeric approaches. For a full list of state codes, legislation and general permits used to determine an overall "statewide" approach, reference the appendix of this report. This review did not include, for example, Phase I permit conditions for individual cities.

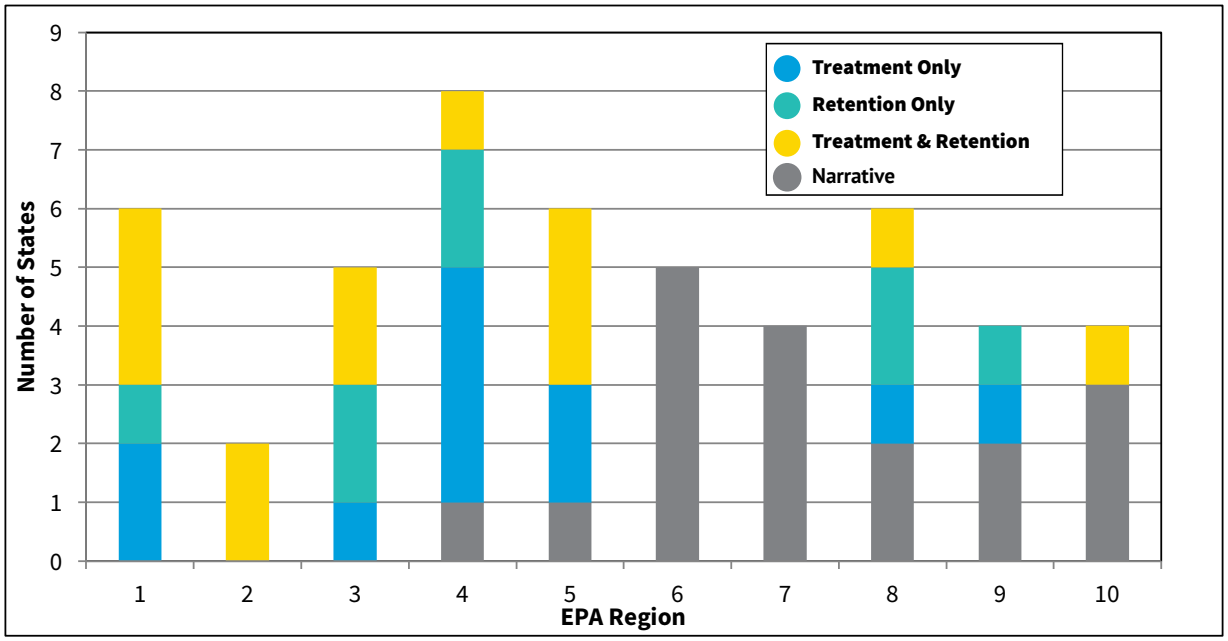
Figure 4. Geographic Distribution of Post-construction Standard Approaches (2017)

Note: This assessment does not account for state regulation or legislative changes after June 2016.



Numeric approaches are present everywhere except Regions 6 and 7. Every state in Regions 1, 2 and 3 (Northeast and Mid-Atlantic) employs a numeric-limit based approach. Given the large number of states with narrative standards, it is likely that there will be significant changes over the coming years, particularly in the heart of the country. In addition, because five states that rely on the narrative approach are operating under expired permits (New Mexico, Nebraska, South Dakota, Wyoming and Hawaii), they, too, will likely experience change.

Figure 5. Post-construction Standard Approaches in Each EPA Region (2017)



Trend to Watch: Retention-based Standards

Many post-construction stormwater programs promote the use of green infrastructure to capture and retain stormwater runoff on-site. It follows that many of these states have determined that a retention-based standard is the best way to encourage green features. Massachusetts, Mississippi and Utah adopted retention-based standards in 2016. Several other states are in the middle of changing their approaches from narrative or treatment-only standards to standards that incorporate retention-based limits. For example, while New Mexico's 2007 general small MS4 permit employed a narrative approach, its new draft permit contains a retention-based standard.

Georgia is another state on the cusp of adopting a stricter retention-based limit. While the state's general permit for Phase II Stormwater discharges does not expire until December 2017, the revised Georgia Stormwater Management Manual, released in January 2016, incorporates 12 recommended stormwater management standards.[xiii] These design standards allow communities to adopt runoff reduction and/or water quality treatment. While the manual does not have regulatory authority, Georgia regulators have indicated that some form of runoff reduction will be included in the next Phase II permit. It is expected that more states will consider incorporating reten-tion-based approaches in the future, as EPA continues to promote this method to reach both water quality and quantity goals.

2.3 Typical BMPs Associated with Each Post-construction Approach

BMP selection is driven by a number of factors, including topography, land use, maintenance requirements and underlying soil conditions. A state's post-construction standard can also have a significant impact.

The chart below identifies typical BMPs used to comply with the four main post-construction approaches. It is a starting point for understanding what BMPs developers can reasonably expect to use when complying with different approaches. State or local requirements and design standards may allow for different combinations. Some jurisdictions, for example, provide limited retention credit for wet ponds or stormwater wetlands containing vegetation due to evapotranspiration. Still others allow for features to be used in succession, also known as a "treatment train" approach.

Table 1. BMPs Typically Associated with Each Post-construction Standard Approach

Best Management Practice	Narrative	Treatment-only	Retention-only	Treatment & Retention
Bioretention/Rain Gardens	🔵	🔵	🔵	🔵
Bioswales	🔵	🔵	🟡	🔵
Downspout Disconnects	🔵	🟡	🔵	🔵
Dry Detention Basins	🔵	🔵	🟡	🔵
Dry Wells	🔵	🟡	🔵	🔵
Enhanced Swales	🔵	🔵	🔵	🔵
Grass Channel	🔵	🔵	🟡	🔵
Gravity (Oil-Grit) Separators	🔵	🔵	🟡	🔵
Green Roofs	🔵	🟡	🔵	🔵
Infiltration Trenches	🔵	🟡	🔵	🔵
Organic/Sand Filters	🔵	🔵	🟡	🔵
Permeable Bricks/Blocks	🔵	🔴	🔵	🔵
Pervious Concrete	🔵	🔴	🔵	🔵
Porous Asphalt	🔵	🔴	🔵	🔵
Proprietary Systems	🔵	🔵	🔴	🔵
Rainwater Harvesting	🔵	🟡	🔵	🔵
Site Restoration/Revegetation	🔵	🔵	🟡	🔵
Soil Restoration	🔵	🟡	🔵	🔵
Stormwater Planters/Tree Boxes	🔵	🔵	🔵	🔵
Stormwater Ponds	🔵	🔵	🔴	🔵
Stormwater Wetland	🔵	🔵	🔴	🔵
Vegetated Filter Strips	🔵	🔵	🟡	🔵

🔵 – Typically can be effective 🟡 – Might be effective 🔴 – Not likely effective

As shown, narrative and combined treatment/retention approaches tend to afford the most flexibility. Treatment-only and retention-only approaches may limit the available number of features to choose from. While some states may prefer to adopt a regulatory approach that affords maximum flexibility, others have chosen to simplify the compliance and review process by limiting the number of BMPs to a few easy-to-design features.

2.4 Pros & Cons

Selecting a workable stormwater approach is not easy. There are many considerations that a state must take into account, including how well the program is likely to meet overall goals, state geography and development patterns, administrative resources and enforceability.

In some cases, supporting program elements such as off-site mitigation or fee-in-lieu programs help ensure an approach is workable for the majority of sites.

Regulatory Approach	Pros	Cons	Solutions to Make this Approach Workable for Residential Sites
Narrative	• Cities have freedom to adopt a broad range of measures taking into account local soil, rainfall and development patterns. • Developers can choose from a wide range of BMPs. • Easy to understand.	• Lack of direct, explicit requirements. • Inconsistent standards across a state. • Different interpretations of how standard should be enforced (e.g. “minimize discharge of pollutants”).	• Standard should include optional “safe harbor” (e.g., a list of acceptable methods or practices to achieve compliance) so that developers know exactly what to do.
Treatment Only	• Can work well when a design manual is available to provide implementation guidance. • Some states allow the use of low-cost, non-structural BMPs, such as fertilizer reduction to demonstrate compliance.	• If standards require a certain % pollutant removal, sites with very low pollutant loads may have difficulty demonstrating compliance. • If BMP efficiencies are assumed, some states may limit available design options based on assumed removal of pollutants.	• Standard should assign clear long-term maintenance responsibilities. • Provide easy-to-use spreadsheet based tools to demonstrate compliance. • Provide pollutant reduction credit for non-structural practices like fertilizer reduction or leaf litter control. • Provide mitigation, fee-in-lieu or trading options for difficult sites.
Retention Only	• Can work well when a design manual is available to provide clear implementation guidance. • Can help reduce localized flooding. • “Good site planning” (e.g., reduction of connected impervious surface) can significantly reduce compliance costs.	• Potential groundwater contamination or mobilization of pollutants from contaminated sites. • Native soils must have adequate infiltration rates. • Limited BMP choice.	• Standard should assign clear long-term maintenance responsibilities. • Provide credit for use of features that meet both water quality and drainage/flood requirements. • Provide mitigation, fee-in-lieu or trading options for difficult sites.
Treatment & Retention	• Developers can choose from a wide range of BMPs. • Can work well when a design manual is available to provide clear implementation guidance. • Can help reduce localized flooding. • Good site planning (e.g., reduction of connected impervious surface) can significantly reduce compliance costs.	• Multiple criteria impacting BMP design may create confusion. • Potential groundwater contamination or mobilization of pollutants from contaminated sites. • Native soils must have adequate infiltration rates.	• Standard should assign clear long-term maintenance responsibilities. • Allow for design of features that meet both water quality and drainage/flood requirements. • Provide mitigation, fee-in-lieu or trading options for difficult sites.

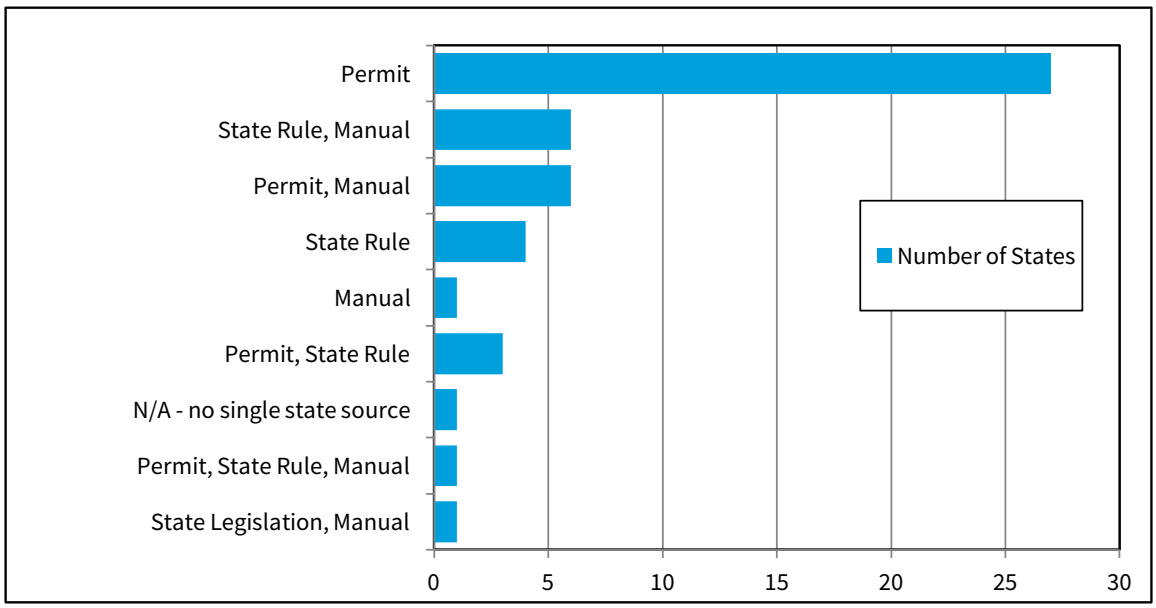
2.5 Source of State Standards

Increasingly, states are adopting numeric limits in BMP manuals rather than permits.

While each state's Phase II general permit is expected to outline the requirements small MS4s must follow to comply with their NPDES obligations, that is not always the case. States continue to rely on other documents and manuals to provide additional technical specifications or otherwise supplement their permits. Almost half of states house their standards in a document other than an MS4 general permit. This can cause problems. Although developers must comply with post-construction stormwater standards, they are not always invited to participate when new rules are developed. The fact that new standards are being adopted in multiple venues is not only confusing, but it can result in conflicting requirements and outcomes. What's more, NPDES permits may reference or incorporate detailed criteria from state design manuals or other documents, but fail to reference a specific date or version. This poses several dangers, including inadvertently relying on an expired manual or, by allowing that manual to be updated over time, surreptitiously changing the standards or permit requirements outside of the regular five-year permit cycle.

Figure 2. Post-construction Standard Sources (2016)

The basis of state post-construction stormwater standards can be found in permit(s), manuals, state rules or legislation, or a combination thereof. The majority of post-construction standards are included in NPDES MS4 general permits.



The number of permit-based standards is lowest in the Northeast (EPA Regions 1, 2, and 3). Almost all post-construction standards in the Midwest and West regions of the United States are found in a permit or in a permit and another source. One of the reasons combined Treatment and Retention approaches can be so confusing for the development community is that treatment standards are often housed in state rules (e.g., remove 80% TSS), while retention standards are more often part of a state's NPDES permit. It is often not clear how the two requirements work together. While guidance materials can be helpful to explain the interaction between state laws impacting water quality and quantity and MS4 permits, any such supplemental manuals must be non-regulatory in nature and refer users to permits and state regulations for regulatory requirements.

Considerations

- ✔ Monitor your state's Phase II MS4 NPDES permit five-year timeline and make sure you understand the process the state will follow to reconsider and reissue the permit.
- ✔ Before the MS4 Phase II general permit comes up for renewal, start asking questions to determine if there will be major changes in the next version. How is the success of the permit being determined? What type of analyses are regulators performing? Are they considering making any changes to the post-construction approach they are using? Why? Has the success of similar standards in neighboring areas or climates been evaluated?

Digging Deeper

- ✔ Which post-construction approaches have been adopted in neighboring states, and why? How do they differ from your state's approach in on-the-ground requirements or program administration? Are there notable differences in results?
- ✔ Contact HBAs in neighboring states to determine how their post-construction stormwater standards are being implemented. Compare impacts, burdens, costs, etc. to determine how and why these factors differ.
- ✔ Encourage your state, county and/or municipality to form a stakeholder committee that meets periodically to assess and recommend changes to stormwater permits, design manuals and other documents; identify conflicting or redundant requirements; and develop solutions to improve administration and overall program results.

Resources

- ✔ Compendium of Ms4 Permitting Approaches - Features examples from existing MS4 permits of "clear, specific, and measurable requirements".
- ✔ EPA Summary of State Stormwater Standards. This document summarizes post-construction standards for stormwater discharges from newly developed and redeveloped sites for all 50 states and the District of Columbia (June 2016).
- ✔ EPA's Small MS4 Remand Rule – Fact Sheet on U.S. EPA's 2016 Final Small MS4 Remand Rule revisions.

Maintenance crews extract a permeable paver to check for clogging.

Alisha Goldstein

3.1: Maintenance Responsibility

59% of Phase II general permits assign long-term maintenance responsibility for post-construction controls.

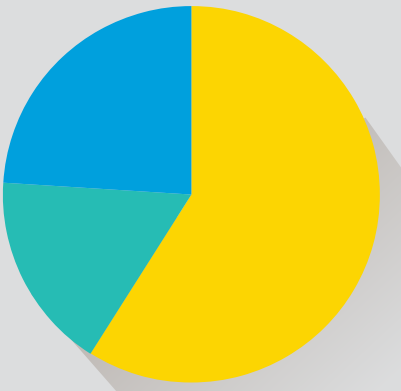


Figure 6. Phase II General Permits Assigning Long Term Maintenance Responsibility (2017)

Data collected for this review was limited to Phase II general permit language. Other state or local rules may impose additional requirements. Tally does not include Maryland and Indiana because they defer to state rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits.

- Mandatory Language
- Optional Language
- No Permit Condition Addressing this Topic

Communities have a vested interest in ensuring that post-construction controls continue to function properly. Through inspections and monitoring, MS4s must demonstrate compliance and progress towards reaching water quality goals. Many jurisdictions struggle with common maintenance problems, such as restricted or clogged outlets that can cause stormwater to back up, often resulting in temporary upstream flooding or re-mobilization of pollutants.

As the sophistication of MS4 programs evolve, so do requirements for long-term maintenance of stormwater controls. For example, Colorado conducted audits of several post-construction BMPs and determined that overall, they were not being built and maintained adequately. As a result, the state's 2016 permit requires oversight inspections of all BMPs at least once in every five-year permit term. As of April 2017, **25** states incorporated mandatory language assigning long-term maintenance responsibility for BMPs in their Phase II general permits. An increasing number of permits also require construction verification, including North Dakota, Nevada, Kentucky, Florida, Maine and New Hampshire. Construction verification generally requires the submission of as-built designs and may include inspections during BMP construction. That being said, many states leave it up to each MS4 to determine how adequate maintenance will be accomplished for features located on private land.

Protecting Developments from Liability

It is in the developer's best interest to navigate maintenance agreements carefully to ensure that he/she is not left liable for BMP function long after the project has been completed. What's more, developers must ensure that home owner associations or other entities realize what new legal responsibilities they have when taking ownership of such features. Because most states still have not developed a process to track BMP maintenance responsibilities after properties are sold or transferred, it is all the more important to ensure that such issues are specifically addressed in development covenants or deed restrictions. In addition, developers may want to plan for and provide permanent access ways and easements to assist with the long-term maintenance of stormwater control features.

Most commonly occurring Phase II language relating to long-term maintenance:

- *Develop procedures to ensure adequate long-term operation and maintenance.*
- *Enforce requirements for other parties, both public and private, to maintain post-construction controls.*
- *The responsibility for implementation of long term operation and maintenance of a post-construction stormwater management practice shall be vested with a responsible party by means of a legally binding and enforceable mechanism such as a maintenance agreement, deed covenant or other legal measure.*

REGION 1

All six states in Region 1 provide language on mechanisms to guarantee responsibility for long-term maintenance, with only Connecticut, Maine, New Hampshire and Vermont *requiring* the adoption of such mechanisms. Permit language in this region ranges from **Rhode Island's** 2003 directive, which simply asks permittees to develop a program with "procedures to ensure adequate long term operation and maintenance" and sanctions to ensure compliance, to **Maine's** 2013 Phase II Permit, which provides much more specificity. Maine's permit writer has acknowledged that BMPs are only as good as their maintenance and that BMPs have a high rate of failure in their first year. As a result, Maine's permit requires owner/operators of post-construction BMPs to file an annual report documenting adequate maintenance. MS4s are also responsible for annually inspecting a percentage BMPs.

Connecticut's 2017 Phase II permit requires maintenance plans for all retention or detention ponds in the state's Urbanized Area that discharge to an MS4, including removal of accumulated sediment when it exceeds 50% of the design capacity.

Both **New Hampshire's** 2017 Phase II permit (not effective until July 2018) and **Massachusetts'** 2016 permit (also not effective until July 2018) state that MS4s "shall have procedures to ensure adequate long-term operation and maintenance of stormwater management practices that remain in place after the completion of a construction project." Procedures *may include* the use of dedicated funds or escrow accounts for development projects or the acceptance of ownership by the permittee of all privately owned BMPs, maintenance contracts, or submission of an annual certification documenting the work that has been done over the last 12 months to properly operate and maintain the stormwater control measures. Both permits require MS4s to submit as-built drawings no later than two years after completion of projects. New Hampshire's permit also refers to state rules that require identification of a responsible party for the long-term maintenance of each feature. State rules also require extensive reporting, including ongoing reporting on issues affecting BMPs ranging from de-icing chemicals to invasive species. **Vermont's** 2012 permit requires traditional and non-traditional MS4s (such as DOTs) to cooperate when runoff moves across jurisdictional boundaries, and incorporates maintenance requirements for individual treatment practices from Vermont's State design manual.

REGION 2

New York's 2015 Phase II permit requires MS4s to complete an inventory of post-construction practices that includes maintenance dates and types of maintenance performed. The permit also refers to the New York design manual that states, "the responsibility for implementation of long term operation and maintenance of a post-construction stormwater management practice shall be vested with a responsible party by means of a legally binding and enforceable mechanism such as a maintenance agreement, deed covenant or other legal measure." **New Jersey's** permit refers to maintenance guidelines in the New Jersey BMP Manual, as well as New Jersey's administrative regulations. These regulations require development applicants to indicate the person or entity responsible for maintenance. If the responsible party is not a public agency, deed or property records shall include maintenance plan specifications.

REGION 3

West Virginia is another state with strong, legally binding maintenance requirements. Its Phase II permit gives owners/developers the option to sign a statement accepting responsibility for maintenance until transferred, or to ensure long-term maintenance via written conditions in sales agreements, leases or project conditions, covenants, or deed restrictions.

Because **Maryland** has a robust stormwater management program that regulates new and redevelopment projects, the state considers local compliance with the state stormwater statute to constitute compliance with all federal minimum control measures.

In the **District of Columbia,** the 2011 permit requires the adoption of accountability mechanisms to ensure maintenance of stormwater control measures on non-District property, which may include combinations of deed restrictions, ordinances, maintenance agreements, or other policies. The permittee must also complete a long-term verification process to prove there will be adequate operation and maintenance, which may include municipal inspections, third-party inspections, owner/operator certification or other mechanisms.

Virginia's 2013 permit requires private BMP owners to develop and record an inspection schedule and maintenance agreement to the extent allowable under state or local law. Virginia also requires inspection of all privately owned features on a five-year cycle.

Pennsylvania's 2013 permit requires MS4s to develop provisions to ensure that proper operation and maintenance is performed by the owners and operators of all stormwater BMPs, including sanctions and penalties for non-compliance with long-term maintenance plans for post-construction features.

REGION 4

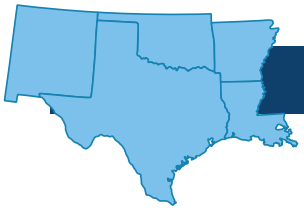
Region 4 contains some of the strictest binding maintenance programs in the country, with the **Alabama**, **Georgia**, **Mississippi**, **Kentucky** and **Tennessee** general permits all requiring legally binding maintenance agreements for post-construction practices. **Kentucky** specifically requires deed restrictions and covenants, while the other four states provide discretion to localities on which types of agreements they may adopt. **Kentucky's** 2010 permit also specifies that agreements shall allow the MS4 to perform any necessary maintenance or corrective action neglected by the property owner and recover costs for doing so. **North Carolina** uses individual permits for all MS4s, but relies on a permit template that requires some type of mechanism, such as recorded deed restrictions and protective covenants, to ensure projects are maintained consistent with approved plans. **South Carolina's** 2014 permit requires that the site plan review process specifically address how the project will ensure long-term maintenance of stormwater facilities.

The **Mississippi** and **Alabama** permits issued in 2016 provide the biggest range of options for proof of such an agreement, including the developer's signed statement accepting responsibility for maintenance until legally transferred, written conditions in the sales or lease agreement, project conditions, covenants assigning responsibility to a home owners' association, or "any other legally enforceable agreement that assigns permanent responsibility." The **Georgia** permit, expiring in December 2017, as well as **Tennessee's** 2016 permit, require MS4s to either conduct maintenance themselves or obtain agreements for long-term maintenance of BMPs located on private property.

REGION 5

In Region 5, three states (**Minnesota**, **Ohio** and **Wisconsin)** require legally binding maintenance agreements for stormwater control features on private property in their general permits. **Minnesota's** 2013 Phase II permit requires that there be "legal mechanisms" between the permittee and owners or operators responsible for long-term maintenance, but only for structural BMPs constructed after the effective date of the permit that are directly connected to the MS4. **Ohio's** Phase II permit requires maintenance plans for all sites in addition to agreements. **Wisconsin's** 2013 permit mandates "long-term requirements" for landowners and provides several examples of different legal mechanisms to ensure clear responsibility.

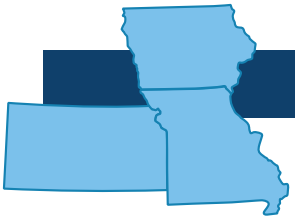
Illinois' March 2016 permit requires new and redevelopment to draft a long-term plan, but does not require legally binding agreements.



REGION 6

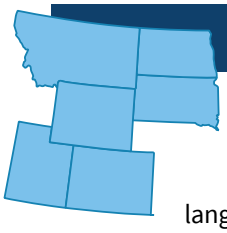
In Region 6, four states discuss assigning maintenance responsibility in their permits, with **Arkansas, Louisiana and Oklahoma** offering only optional language. These three permits require MS4s to "describe how you ensure the long-term operation and maintenance of your selected BMPs," and describe clearly identified agreements between the MS4 and post-development landowners as one way of accomplishing this goal. **Texas'** 2013 permit contains mandatory language making owner/operators ultimately responsible for the maintenance of structural stormwater control measures. Owner/operators must develop a maintenance plan and file it in the real property records of the county. Maintenance performed must also be documented and retained on-site or at the offices of the owner/operator.

New Mexico's 2007 Phase II permit does not contain any legally binding long-term maintenance language for contracts, deed restrictions or agreements, but does require MS4s to, "at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve compliance with the conditions of the permit." A new permit is in development.



REGION 7

In Region 7, only the **Missouri** 2016 Phase II permit contains optional language, requiring MS4s to submit a plan to ensure adequate long-term operation and maintenance of selected BMPs, and (as appropriate) create agreements between the MS4 and post-development landowners. The permit also recommends MS4s include penalty provisions for noncompliance with agreed-upon design or maintenance provisions. The **Kansas** and **Nebraska** permits contain no direction on long-term maintenance agreements or accountability mechanisms.



REGION 8

In Region 8, the **Montana**, **Utah, Colorado** and **North Dakota** Phase II general permits require maintenance agreements: The language differs, but the intent is the same. **Montana's** 2017 permit requires MS4s to adopt separate measures for "informal, formal and judicial" responses to non-compliance. Judicial penalties could include measures such as consent decrees, civil and even criminal penalties.

Utah's 2016 permit is very specific, requiring MS4 ordinances to either require inspection and maintenance of private property features by the MS4, or allow private property owner/operators or qualified third parties to conduct maintenance. In this case, the MS4 must require a maintenance agreement accounting for transfer of responsibility in leases or deeds, allow access to the MS4 for necessary maintenance or corrective actions neglected by the property owner, and bill or recoup costs as needed.

The **Colorado** 2016 permit requires MS4s to adopt maintenance provisions "to the maximum extent under law," and to "implement sanctions" against entities responsible for long-term maintenance. The 2016 **North Dakota** permit leaves discretion open for MS4s to develop binding mechanisms of their choosing to "enforce the requirements for other parties, both public and private, to maintain post-construction controls."

South Dakota's municipal manual suggests that MS4s should require, as part of development plats, that the legal title holder to the property be specifically noted as being responsible for maintaining the BMPs.

REGION 9

In Region 9, **California** is the only state with mandatory, legally binding language for maintenance in a Phase II permit, including deed restrictions, covenants and any other legal agreement that assigns operation and maintenance responsibility.

Arizona's 2016 permit requires MS4s to adopt, "to the extent allowed under state law, methods to enter private property for the purpose of inspecting at reasonable times any facilities, equipment, practices, or operations related to stormwater discharges to determine whether there is compliance," as well as "processes and procedures" necessary to ensure the long-term operation and maintenance of post-construction stormwater BMPs.

REGION 10

In Region 10, the permit for **Eastern Washington** suggests periodic inspection and recommended maintenance, as well as a five-year inspection minimum.

*****NOTE:*** *Regional program summaries only include information on states that reference long-term maintenance in their Phase II general permits. Not all states issue general permits. Information on additional state rules or programs was included where available.*

Considerations — Maintenance Responsibility

- ✔ Is long-term maintenance an issue in your community? Do you have examples?
- ✔ Who is responsible for long-term inspection and maintenance of post-construction stormwater BMPs in your jurisdiction? Is it the same entity in all cases? If not, how is long-term responsibility determined or assigned?
- ✔ How is compliance with maintenance requirements measured and ensured? Does the municipality have the resources to conduct inspections and follow-up?

Digging Deeper

- ✔ Are there steps state and local officials can take to encourage the design and installation of stormwater control features that require minimal maintenance? Which BMPs might meet this definition?
- ✔ What legal mechanisms are used to assign maintenance responsibilities? Language that assigns long-term responsibilities to the municipality, home owners association or other entities in covenants, easements and other agreements can help to clarify obligations. Ensure that the agree-ments allow for access for outside inspectors, if applicable.
- ✔ Make sure maintenance requirements are clear and understandable. For ease of compliance, consider creating a regular schedule, such as cleaning out debris every six months in lieu of performance-based requirements that direct clean out when the debris reached 50% of capacity.
- ✔ Does the local jurisdiction have a dedicated funding source or program for the long-term maintenance of features on private property? If not, consider working with state and local entities to develop mechanisms for funding and financing of long-term maintenance of stormwater controls so that costs and liabilities are not passed on to home owners.

Resources

- ✔ The University of New Hampshire Stormwater Center - The center serves as a technical resource for those who want to know more about the design, cost, maintenance and operations of stormwater management systems.
- ✔ Green Stormwater Operations and Maintenance Manual – This Seattle Public Utilities manual summarizes routine maintenance activities for rain gardens, vegetated swales and permeable pavements. It describes four levels of service from excellent (Service Level A) to poor effort (Service Level D).

Traditional drainage infrastructure uses pipes and concrete to move water away from sites as quickly as possible. Today stormwater requirements often ask developers to infiltrate or capture water on-site.

3.2: Flood Control

Just over 30% of Phase II general permits mandate consideration of flood or drainage control.

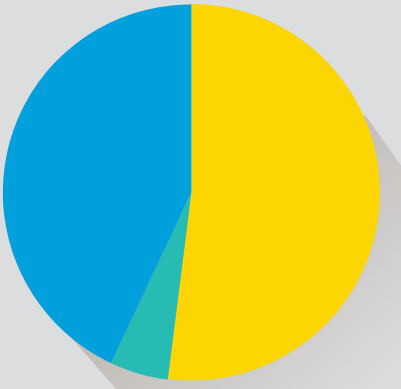


Figure 7. Phase II General Permits with Flood Control Provisions (2017)

Data collected for this review was limited to Phase II general permit language. Other state or local rules may impose additional requirements. Tally does not include Maryland and Indiana since they defer to State Rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits.

- Mandatory Language
- Optional Language
- No Permit Condition Addressing this Topic

Just under **45%** of the permits surveyed had no language tying stormwater control to flood or drainage standards. Twenty-two state Phase II permits contained mandatory language addressing flooding or drainage. A number of states referenced additional flood control provisions in state legislation, regulations and/or design manuals.

Historically, local governments regulated stormwater flows leaving development sites for one reason – flood control. Accordingly, early regulations focused on getting water off sites and into storm drains as quickly as possible. Today, water quality concerns and accompanying Clean Water Act obligations play an equal, if not larger role. Many post-construction regulations now require developers to slow, control, infiltrate and treat water before it leaves the site.

It follows that stormwater regulations can cause a number of headaches if not properly incorporated into existing drainage and flood control requirements. Although flood control triggers are usually based on the 100-year return frequency storm, and post-construction programs typically focus on a five-year or less return frequency storm, both flood control and stormwater management are ultimately focused on where and how to direct flow and reduce volumes and velocities.

Despite these similarities, NAHB members report overlapping and contradictory standards and missed opportunities to properly account for the full benefits of certain control features that may satisfy both standards. Coordination is essential to avoid such design and compliance challenges. In fact, in many cases, drainage infrastructure is funded by the same stormwater utilities that finance water quality programs in regulated MS4 communities. Working with these local utilities could help to ensure that programs allow for designs that meet both requirements.

<u>Most commonly occurring Phase II language related to flood control</u>:

- *Consider water quality concerns when constructing or modifying regional flood control features.*
- *Peak flow reduction for 2-, 4-, 10-, 50- and 100-year storm events (usually incorporated from state flood rules or design manual).*
- *Consider non-structural controls such as directing development outside of floodplains, or constructing multiple-benefit flood/water quality features.*

REGION 1

In Region 1, several states require the consideration of flood control, with most states specifying limits on peak discharge rates for pre- vs. post-development or specific storm events.

Maine's state regulations require stormwater management systems to detain, retain, or infiltrate stormwater such that post-developed peak flows from the 2-year, 10-year and 25-year, 24-hour storm frequencies do not exceed pre-developed peak flows. Maine's Phase II General Permit directs MS4s to ensure that new flood and stormwater management projects assess impacts on water quality and examine existing projects for opportunities to incorporate additional water quality protection devices or practices.

Rhode Island's Design Manual requires peak flow attenuation for the 10-year, and 100-year, 24-hour storm events. The **Vermont** Design Manual requires overbank protection such that the post-development peak discharge rate does not exceed the pre-development peak discharge rate for the 10-year, 24-hour storm event. The 10-year control requirement can be waived if the developer demonstrates that there will be no increase in flood threat downstream, as determined by downstream hydrologic/hydraulic analyses.

Massachusetts' 2016 Phase II permit (not effective until July 2018) requires MS4s to control peak runoff rates in accordance with the Massachusetts Stormwater Handbook, which requires that post-development peak discharge rates not exceed pre-development peak discharge rates. This standard may be waived for discharges to lands that are subject to coastal storm flows. The 2017 **New Hampshire** Phase II permit (not effective until July 2018) also requires consideration of flood control during post-construction. The permit references the state's *Peak Runoff Control Requirements*, which outlines acceptable peak flow rates, as well as the mandate to prove there will be no impact to properties as a result of developing within the 100-year floodplain.

REGION 2

New Jersey requires Phase II MS4s to use hydrologic and hydraulic design calculations to demonstrate that post-construction runoff hydrographs are managed for the 2-, 10- and 100-year storm events.

New York's 2015 permit requires small MS4s to design features according to standards defined in the most current version of the Stormwater Management Design Manual, which calls for overbank control storage to attenuate the post development 10-year, 24-hour peak discharge rate to predevelopment rates.

REGION 3

The **District of Columbia's** 2011 Phase II permit requires the city to undergo a number of flood planning activities to assess the potential of flood control features to serve as water quality features and vice versa. The District must review all development proposed to occur in floodplain areas to ensure that the impacts on water quality have been properly addressed. The District must also collect and report on the percentage of impervious surface area within the floodplain boundaries for all proposed and existing development.

Pennsylvania's 2013 Phase II permit calls for no increase in the peak rate of discharge for the 1-year through 100-year events, and, as necessary, mandates additional peak rate control.

REGION 4

In Region 4, **Georgia** and **Tennessee** are the only two states that incorporate mandatory language for flood control via Phase II permits. **Georgia** requires downstream overbank flood protection by mandating that the post-development peak discharge rate be equal to the pre-development rate for the 25-year, 24-hour storm event. And for extreme flood protection, developers must provide features that control the 100-year, 24-hour storm event such that flooding is "not exacerbated." For new and existing flood management projects, water quality impacts must be assessed during the design phase. **Tennessee's** 2016 permit holds that the MS4 must consider ways to evaluate new flood management projects and assess their impacts on water quality, as well as consider opportunities for incorporating additional water quality protection.

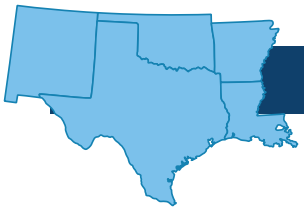
In **North Carolina**, flood control is generally overseen by local governments. **South Carolina** relies on state code, which requires post-development peak discharge rates to not exceed pre-development discharge rates for the 2-and 10-year frequency, 24-hour duration storm event.

REGION 5

Permits in **Illinois, Minnesota, Wisconsin and Ohio** contain binding conditions for flood control. **Ohio's** 2014 Phase II permit calls on MS4 programs to assess new flood management projects for impacts on water quality, while **Minnesota's** 2013 Phase II permit requires an inventory of all ponds constructed for water quality treatment, detention and flood control. More specific flood and drainage requirements can be administered at the discretion of municipalities.

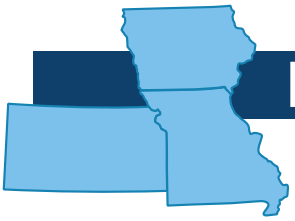
Illinois' 2016 Phase II permit requires all MS4s, within three years, to develop a process to systematically assess water quality impacts in the design of all new flood reduction features. This process must "include consideration of controls that can be used to minimize the impacts to site water quality and hydrology while still meeting program objectives." Assessments must also include potential impacts on flood projects due to climate change.

Wisconsin's permit calls for compliance with state requirements to maintain or reduce the 1-year, 24-hour and the 2-year, 24-hour post-construction peak runoff discharge rates to the maximum extent practicable.



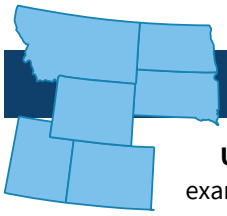
REGION 6

The **Louisiana, New Mexico, Oklahoma** and **Arkansas** Phase II permits require flood control projects to assess impacts on water quality and incorporate additional water quality protection devices, as necessary.



REGION 7

Missouri's 2016 permit also requires MS4s to assess flood control projects for water quality impacts.



REGION 8

Utah's 2016 Phase II permit is a good example of a state working to address potential overlap or conflict between meeting NPDES requirements and local flood requirements. In Utah's response to comment documentation for its 2016 permit, commenters raised concern over whether a new 90th percentile retention standard would lead to standing water in areas with clay soil, posing both a nuisance and drainage risk. Officials responded by noting that "The water quality volume associated with the 90th percentile storm event [retention standard] is not intended to replace permittee's design standards. MS4s may have separate standards for flood control and to meet system capacity." The permit also states that local development/redevelopment programs *shall include* nonstructural BMPs, such as measures for flood control.

North Dakota's 2016 Phase II permit considers flood control interactions as well. North Dakota adopted a "first flush" water quality criteria, which applies to both on-site and regional systems for post-construction stormwater management. The permit states, "water quality considerations do not replace or substitute for water quantity or flood management requirements implemented on the local level for new developments. The water quality features may be incorporated into the design of structures for flow control; or water quality control may be achieved with separate features. If it is impractical to meet the water quality criteria or the lack of right-of-way precludes the installation of described practices, alternative practices (e.g., grassed swales, smaller ponds, or grit chambers) must be provided. If a combination of practices is used, the water quality volume is accounted for on a percentage basis."

Colorado's 2016 permit specifies that "regional facilities" must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered regional facilities.

REGION 9

Nevada's 2010 Phase II permit requires permittees to adopt procedures to assure that future regional flood management projects assess impacts on water quality. It also requires permittees to describe how they will develop design standards for peak urban runoff to provide protection against downstream erosion.

California's 2013 Phase II permit allows MS4s to propose alternative post-construction measures in lieu of some or all of the requirements by installing multiple benefit projects. Multiple-benefit projects include those that address both stormwater and community interests, such as water supply, flood control, habitat enhancement or open space preservation. In addition, within the third year of the effective date of the permit, the MS4 must have a process in place for incorporating water quality and habitat enhancement features into all new and rehabilitated flood management facilities.

*****NOTE:** Regional program summaries only include information on states that reference flood control in their Phase II general permits. Not all states issue general permits. Information on additional state rules or programs was included where available.*

Considerations – Flood Control

- ✔ Is the conflict between flood control and water quality an issue in your jurisdiction? Do you have examples?
- ✔ Does your state or locality require the consideration of *both* flood and stormwater control measures when planning a project? What entity oversees this coordination?
- ✔ Does the jurisdiction use the same approval process for flood and storm water control measures, such as features that meet both detention/drainage and water quality requirements? Is this process predictable and timely?

Digging Deeper

- ✔ Can the design approval process for water quality features that provide flood control benefits be streamlined through consolidating departmental review or providing a dedicated staff person with the necessary expertise to review integrated water quality and flood control designs?
- ✔ Has your local stormwater program been assessed using EPA's Water Quality Scorecard or a similar tool to verify whether the municipality's codes and ordinances present barriers to implementing water quality features on development projects?

Resources

- ✔ Flood Loss Avoidance Benefits of Green Infrastructure for Stormwater Management – 2015 study prepared for EPA that estimates the monetary value of flood loss avoidance that could be achieved by using distributed stormwater controls to capture a specified volume of runoff.
- ✔ EPA: Flood Risk & Green Infrastructure – Clearinghouse site for resources related to how green infrastructure can help manage both localized and riverine floods.
- ✔ Envision Sustainable Infrastructure Rating System – Business Case Evaluator for Stormwater —This tool from the Institute for Sustainable Infrastructure estimates the value of green infrastructure benefits, including reduced flooding resulting from green infrastructure improvements.
- ✔ EPA Water Quality Scorecard – Guide to help local governments better protect water quality by removing barriers and revising codes, ordinances and incentives. The scorecard guides municipal staff through a review of relevant local codes and ordinances in multiple departments to ensure that these codes work together to support a green infrastructure approach.

Small, distributed green infrastructure practices can help manage localized flooding and basement backup events. For larger storms, most infiltration controls have overflow drains such as the one pictured here.

Nancy Arazan

3.3: Green Infrastructure & LID Requirements

50% of Phase II general permits contain mandatory language concerning the use of green infrastructure and LID.

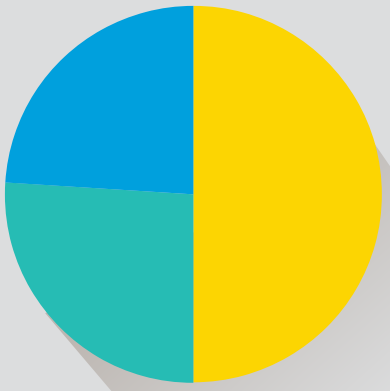


Figure 8. Phase II General Permits with LID/Green Infrastructure Provisions (2017)

*Data collected for this review was limited to Phase II general permit language. Other state or local rules may impose additional requirements. Tally does not include Maryland and Indiana since they defer to State Rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits. *Note: Washington in EPA Region 10 has two different Phase II general permits. LID and/or GI is optional in the Eastern Washington Permit and mandatory in the Western Washington Permit.*

- Mandatory Language
- Optional Language
- No Permit Condition Addressing this Topic

Green infrastructure continues to be popular for a growing number of municipalities seeking viable and attractive ways to meet both water quality and community development goals. As of April 2017, **32** states include LID and/or green infrastructure in their Phase II general permit language. At least **six** states include provisions in other documents such as state legislation, regulations rules and/or design manuals.

According to EPA, "At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water." Examples may include infiltration trenches, drywells, bioswales, rain gardens, green roofs, cisterns, dispersion and vegetated wetlands. LID refers to principles such as preserving and recreating natural landscape features, or minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product.

EPA strongly encourages the inclusion of LID and green infrastructure in NPDES Phase II permits, and has argued that green infrastructure can in many cases reduce total project cost compared to traditional drainage infrastructure.[xiv] Since 2012, the agency has released a series of technical reports as well as NPDES permit compendiums that track the use of green infrastructure in post-construction programs.

Asking the Right Questions

By asking the right questions early, builders have the opportunity to make regulations more cost effective and easier to implement. The Building Industry Association of Washington (BIAW) recommends that builders use knowledge of local development practices to identify potential policy issues and define the "feasibility" of green infrastructure/LID in their jurisdictions.[xvi]

- *How will LID or green infrastructure affect my existing development approval and design process?*
- *Will required landscaping elements be able to be converted to bio-retention features?*
- *Will parking requirements and road widths be relaxed to reduce impervious surface and save construction costs?*
- *Will requirements for detention basins or wet ponds be waived in lieu of installing smaller practices distributed throughout a site?*
- *Will collected rainwater be allowed for potable uses or irrigation to save owners ongoing operation costs?*

Removing Code and Ordinance Barriers to LID

When permits require a post-construction approach using infiltration, evaporation, or capture for reuse, localities need to ensure local codes do not encumber efforts of developers to install green practices. For example, Volume 1 of the New Hampshire Stormwater Manual states that although "methods that either preserve or mimic the natural condition of a site…can potentially reduce the number and size of structural management practices (i.e., stormwater ponds, infiltration basins, sand filters) that are needed to treat stormwater… many municipal ordinances and codes do not allow for them to be used."[xv] As a result, New Hampshire, as well as a number of other states, specify in their Phase II permits that MS4s must assess zoning and construction codes to allow for features such as green roofs, infiltration practices and water harvesting devices.

Most commonly occurring Phase II language related to green infrastructure:

- *MS4s must conduct a local code and ordinance review to identify barriers to implementing green infrastructure and LID practices.*
- *LID/green infrastructure must be used to the maximum extent practicable/feasible.*
- *Develop a schedule to remove those barriers that prohibit LID practices selected by the MS4, and provide a justification for each barrier not removed.*

*****NOTE:** Regional program summaries only include information on states that reference green infrastructure or LID in their Phase II general permits. Not all states issue general permits. Information on additional state rules or programs was included where available.*

REGION 1

In Region 1, all six states reference LID and/or green infrastructure in their MS4 Phase II permits, with all but **Maine** including mandatory provisions to either conduct code reviews or prioritize their use.

The 2017 **New Hampshire** (effective 2018) and **Massachusetts** 2016 (effective 2018) Phase II permits include some of the strongest and most comprehensive green infrastructure language in the country. New Hampshire mandates a code review and written report focusing on street and parking lot design standards, along with procedures to ensure local site plan review processes include an evaluation of opportunities for the use of LID and green infrastructure. Both permits contain the blanket mandate that "LID site planning and design strategies must be used to the maximum extent feasible in order to reduce the discharge of stormwater from new development."

Rhode Island's 2003 Phase II permit requires strategies to reduce runoff volume, which "may include minimizing impervious areas such as roads, parking, paving or other surfaces, encouraging and where appropriate preserving, enhancing or establishing buffers along waterbodies." The permit also refers to Rhode Island's design manual, which requires developers to utilize LID site planning and design strategies to the maximum extent practicable. **Vermont's** Phase II permit includes a mandatory LID code review. In addition, the state performed an assessment of the Vermont Stormwater Management Manual to identify lessons learned from early implementation of green practices presented in the manual.

Connecticut's 2017 permit requires MS4s to establish an ordinance, bylaw, regulation, standard condition or other appropriate legal authority that requires the use of LID and runoff reduction to the MEP in local land use regulations, guidance or construction project requirements.

REGION 2

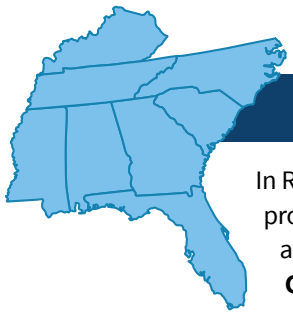
New York's 2015 Phase II Permit requires covered entities to consider principles of Better Site Design (BSD) and Green Infrastructure practices to the MEP. **New Jersey** has mandatory language for LID in state regulations, which are incorporated in New Jersey's 2009 Phase II permit.

REGION 3

In Region 3, **Pennsylvania** and **D.C.** mandate consideration of green infrastructure, while **West Virginia** provides optional language. **Maryland** requires the use of the Maryland Stormwater Design Manual, which requires that environmental site design be implemented to the MEP for all new and redevelopment projects.

The **District of Columbia's** 2011 permit contains mandatory language for green infrastructure that requires MS4s to "integrate stormwater management practices at the site, neighborhood, or watershed levels that are designed to mimic pre-development site hydrology through the use of on-site stormwater retention measures." In D.C.'s draft 2017 Permit, EPA proposed numeric quotas for street trees and the establishment of a tracking system for acres of managed impervious surface.

Pennsylvania's 2013 Phase II permit, in addition to requiring the adoption of ordinances encouraging LID, requires MS4s to report on the number of projects authorized for construction since March 10, 2003 that discharge stormwater to the regulated MS4 and indicate which of those projects incorporated LID practices.



REGION 4

In Region 4, four states have mandatory LID provisions: **Alabama**, **Georgia**, **Kentucky** and **Tennessee**. **Mississippi** and **South Carolina** provide optional language.

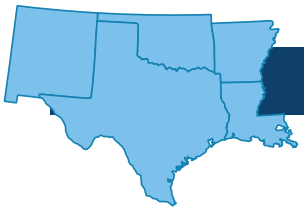
Alabama's 2016 permit requires municipalities to undertake a code review to address barriers to green infrastructure and directs MS4s to consider using LID/green infrastructure "where feasible." **Georgia's** 2012 permit requires code review and revision for cities with populations over 10,000. **Kentucky's** 2010 Phase II permit requires a code review as well, with the additional requirement that each MS4 train program staff on green infrastructure operation and maintenance techniques. In the permit fact sheet, Kentucky also encourages the use of nonstructural BMPs, which it believes to be "generally more cost-effective as a long-term solution." **Tennessee's** 2016 Phase II permit requires riparian buffers to provide additional water quality treatment and allows MS4s to establish permissible land uses or activities within buffer areas, such as biking and walking trails or infiltration-based features. Within one year of obtaining initial permit coverage, Tennessee requires newly permitted MS4s to review their local codes and ordinances using the EPA Water Quality Scorecard.

South Carolina's 2014 Phase II permit provides an optional menu of performance standards that MS4s may adopt, including those that require the use of LID and green infrastructure. **Mississippi's** 2016 Phase II permit recommends that post-construction stormwater control and treatment systems be implemented through a treatment train approach, which incorporates more than one BMP, and suggests a number of green approaches described in the state design manual.

REGION 5

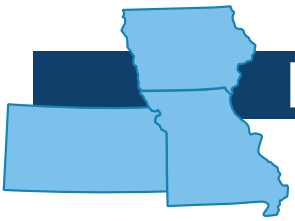
In Region 5, four states have Phase II Permit provisions for LID or green infrastructure. **Minnesota's** 2013 permit mandates the use of a combination of BMPs, with highest preference given to green infrastructure techniques and practices. A *Minimal Impact Design Standards* (MIDS) BMP calculator assists designers and regulators in determining conformance to stormwater performance goals. **Illinois'** 2016 permit requires MS4s to train staff once a year on green infrastructure techniques and maintenance. Illinois also provides language cautioning that infiltration practices should not be used in karst areas, near fueling operations, areas with shallow bedrock, or areas where hazardous or chemical wastes in soil or groundwater could be mobilized via stormwater infiltration.

Ohio and **Wisconsin** have optional provisions. **Wisconsin** simply provides that MS4s "promote" environmentally sensitive land development designs, including LID. Ohio provides a list of standard BMPs approved for general use that include green infrastructure practices. The permit also states that the size of structural post-con-struction controls may be reduced by incorporating non-structural post-construction BMPs into the design, such as open space preservation.



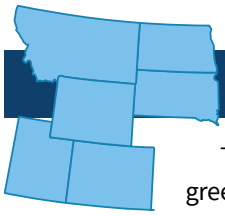
REGION 6

Three states in Region 6 include language on green infrastructure. **Oklahoma's** 2015 Phase II permit requires cities to conduct a mandatory code review to assess barriers to implementing green infrastructure on new development and either schedule the removal of the barriers, or provide a justification as to why certain each barriers were not removed. **Arkansas' and Louisiana's** permits provide optional language, with **Arkansas** recommending that MS4s evaluate existing codes and planning procedures to remove impediments to LID and green infrastructure, while Louisiana authorizes MS4s to adopt policies and ordinances that direct growth to identified areas, protect sensitive areas, minimize impervious surfaces, and minimize disturbance of soils and vegetation.



REGION 7

Missouri is the only state in Region 7 with a permit containing any language on green infrastructure. Missouri's 2016 Phase II permit refers to the *Missouri Guide to Green Infrastructure: Integrating Water Quality into Municipal Stormwater Management* for guidance. The purpose of this non-regulatory guide is to "present green infrastructure as a strategic approach to land development that addresses ecological, economic and social needs, also known as the triple bottom line."



REGION 8

Two states in Region 8 provide mandatory green infrastructure language in their Phase II permits. **Utah's** 2016 permit requires operators to manage the 90th percentile rainfall event on-site using practices that are "designed, constructed, and maintained to infiltrate, evapotranspire and/or harvest and reuse rainwater." If an LID approach cannot accomplish this goal, permittees must explain

why for each project. Utah also mandates annual training of MS4 staff on post-construction stormwater management planning and review. **Montana's** 2017 Phase II permit mandates that all MS4s incorporate recommendations and requirements into plans, policies and ordinances that allow and support the use of LID concepts on public and private property, including a mandatory code review discussion attended by staff from departments including planning, public works, transportation and parks and recreation.

North Dakota's 2016 Phase II permit allows for LID and/or green infrastructure practices to be used as an "alternative" to other post-construction controls, while **Colorado's** 2016 permit contains optional language for use of both of these mechanisms.

REGION 9

The 2013 **California** Phase II general permit requires permittees to "conduct an analysis of all applicable codes, regulations, standards, and/or specifications to identify modifications and/or additions necessary to fill gaps and remove impediments to effective implementation of project-scale [LID] requirements". Small MS4s may choose to comply with post-construction stormwater management requirements based on the watershed-process approach developed by their regional water board.

Nevada's 2010 Phase II permit employs a flexible yet mandatory approach, directing each MS4 to develop LID measures that are "effective and appropriate for the Permittee's locality and its environment."

REGION 10

In Region 10, **Western Washington's** 2014 Phase II MS4 permit mandates local code review and revision of any and all "enforceable documents" or codes to incorporate and require LID.

Building Industry Association of Washington (BIAW) installed rain gardens at its headquarters to demonstrate the benefits of LID compared to conventional features: lower cost, attractiveness and opportunity to allow for smaller or no detention ponds. In 2012, BIAW helped obtain $1 million from the state legislature for LID training.

BIAW

Considerations – Green Infrastructure & LID

- ✔ Does your state/locality allow the use of LID and/or green infrastructure?
- ✔ Has your local jurisdiction performed a code and ordinance review to ensure they don't create a disincentive to using LID or green infrastructure practices?
- ✔ Do the LID and/or green infrastructure ordinances include sufficient detail so that they can be implemented consistently across projects (e.g., each developer is not required to negotiate setback requirements, drainage standards or easements, plumbing codes, etc. on a case-by-case basis)?

Digging Deeper

- ✔ If projects are required to use LID or green infrastructure on a given site, how is feasibility determined and who retains decision-making and oversight responsibility? Will more than one entity have to sign off during the development review process? Can the process be streamlined?
- ✔ How will LID and/or green infrastructure practices be coordinated with other site requirements and characteristics? For example, can required landscaping elements be converted into bio-retention features? Will minimum parking requirements or street widths be reduced to allow developments to take credit for reduced impervious surface?
- ✔ Collecting data on the costs of designing and constructing green features can help identify which measures may be most cost-effective. What factors increase costs the most (e.g., materials, delay in permitting, hiring technical expertise to develop site designs, etc.)? Are there ways to reduce those expenditures?

Resources

- ✔ EPA Green Infrastructure Program - A compilation of a number of resources, a literature review, fact sheets and technical guidance.
- ✔ Building Industry Association of Washington - LID resource page.
- ✔ Advanced Stormwater Standards Compilation Report – 2012 assessment of the Vermont Stormwater Management Manual, including lessons learned from green infrastructure installation.
- ✔ Minnesota *Minimal Impact Design Standards* (MIDS) BMP calculator – Calculator tool used to determine stormwater runoff volume and pollutant reduction capabilities of various LID BMPs.

3.4: Off-site Compliance & Fee-in-lieu Options

Only 7% of Phase II general permits require an off-site compliance, mitigation or fee-in-lieu program for sites that cannot fully meet post-construction requirements.

Figure 9. Phase II General Permits with Off-site Compliance Provisions (2017)

Data collected for this review was limited to Phase II general permit language. State or local rules may impose additional requirements. Tally does not include Maryland and Indiana since they defer to state rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits.

- Mandatory Language
- Optional Language
- No Permit Condition Addressing this Topic

Off-site compliance, mitigation and fee-in-lieu programs give developers alternatives when a site is not conducive to stormwater BMP implementation. Off-site compliance programs typically provide the opportunity to obtain equivalent stormwater storage or treatment on a different property, while fee-in-lieu programs allow developers to pay a fee to fund stormwater control practices to be implemented at the discretion of the jurisdiction. Fee-in-lieu programs typically fund projects in the same watershed or subwatershed and pricing levels are often tied to either the volume or rate of runoff generated by a given development.[xvii]

States implementing treatment and retention or retention-only approaches tend to benefit the most from having mitigation or fee-in-lieu options. Limiting conditions include brownfields, capped landfills, shallow bedrock, elevated groundwater, steep slopes, space constraints, groundwater contamination; poorly infiltrating soils, shallow bedrock, prohibitive costs, leaking sanitary sewers under or adjacent to the planned infiltration area, or a land use that is inconsistent with capture and reuse. In most cases difficult sites will often still be able to achieve a certain percentage of treatment through creative engineering, but need assistance to achieve full compliance.

While only **7%** of the Phase II general permits require off-site compliance, mitigation, or fee-in-lieu program, nearly a third (**31%**) include optional language. Permit provisions were considered to contain "mandatory" language if they stipulated that each MS4 "must" or "shall" institute a fee-in-lieu or off-site mitigation option within its jurisdiction. States categorized as having "optional" language allowed for the adoption of formal off-site mitigation programs at the MS4's discretion. Many of these permits provide basic stipulations or parameters for how such a program should be run, if adopted.

For example, most programs limit off-site mitigation to within a specific watershed size, with the size varying widely. New Hampshire, Tennessee, and Ohio allow mitigation to take place within HUC-10, HUC-12 and HUC-14 units, respectively.[xviii] Several states require that mitigation occur "within the same subwatershed" without defining the term further. Still others place stipulations on the payment or use of fee-in-lieu funds, with some states mandating that individual project developers submit fee amount proposals. Others leave

How far away is too far away for off-site mitigation?

Understanding HUC Boundaries

Most state and local programs limit off-site stormwater mitigation to a specific watershed size. Watersheds in the US are delineated using unique hydrologic unit codes (HUCs). Codes with more digits represent smaller and smaller basins:

2-digit HUC first-level (region)

4-digit HUC second-level (subregion)

6-digit HUC third-level (accounting unit)

8-digit HUC fourth-level (cataloguing unit)

10-digit HUC fifth-level (watershed)

12-digit HUC sixth-level (subwatershed)

**States may break down national data into even smaller units.*

the fee assessment completely up to local authorities. Processes for assessing technical infeasibility also vary widely.

Most commonly occurring Phase II language related to off-site compliance:

- *In cases where the runoff reduction requirement cannot be met, the developer/contractor shall submit, for the permittee's review, a report detailing factors limiting the capability of achieving this goal. In such cases, the permittee shall approve a stormwater mitigation project on another site.*
- *Redevelopment sites may use off-site mitigation within the same HUC-12 to meet the equivalent retention or pollutant removal requirements.*

*****NOTE:** Regional summaries only include information on states that reference off-site compliance or fee-in-lieu options in their Phase II general permits. Not all states issue general permits. Additional state rules or programs were included where available.*

Does my community need an off-site compliance program?

Do the Numbers

A study recently commissioned by Riverside County, California measured the potential real estate development and financial impacts of new post-construction stormwater standards, and found that new limits could significantly affect the financial feasibility of medium-density infill and redevelopment projects. However, the study also determined that a fee-in-lieu option for up to 30% of required volume, if priced at the equivalent cost per gallon treated of a standard stormwater management practice, could successfully address financial feasibility impacts.[xix]

REGION 1

Connecticut is the only state in Region I with a permit requiring off-site compliance or fee-in-lieu options for sites that are unable to fully meet post-construction standards. **Rhode Island, New Hampshire** and **Massachusetts** provide optional language.

The 2017 **Connecticut** Phase II permit stipulates that in cases where the state's runoff reduction requirement cannot be met, the developer must submit a report detailing the factors limiting his/her ability to comply. Fees are calculated based on an estimate of the cost necessary to implement a retrofit to achieve a similar amount of runoff reduction.

In **Rhode Island**, off-site structural BMPs that manage an area equal to or greater than 50% of a redevelop-ment area can meet the water quality requirements, provided the applicant demonstrates that impervious area reduction, LID techniques, or on-site structural BMPs have been implemented to the MEP. **Massachusetts**' 2016 Phase II permit, as well as **New Hampshire's** 2017 permit (both not until July 2018), allow redevelopment sites to utilize off-site mitigation within the same USGS HUC-10 to meet the equivalent retention or pollutant removal requirements.

State rules in **Maine** allow for mitigation within the same watershed, but only if a project is not increasing the pollutant load to an already impaired stream. State rules also allow for off-site compliance on a case-by-case basis. **Vermont** defines the term "offset" in state code as, "a state-permitted or approved action or project within a stormwater-impaired water that a discharger or a third person may complete to mitigate the impacts that a discharge of regulated stormwater runoff has on the stormwater-impaired water."

REGION 2

In Region 2, both **New York** and **New Jersey** provide off-site compliance options. **New York** has optional language in its 2015 Phase II permit allowing MS4s to develop a banking and trading system. Specific requirements must be met, such as ensuring that the offset exceeds the standard pollutant reduction by a factor of two and that the offset is within the same watershed. The New York State Stormwater Design Manual allows redevelopment projects that cannot meet post-construction stormwater standards to participate in off-site watershed improvement. **New Jersey's** permit refers to state rules that allow municipalities to grant a variance or exemption from stormwater design and performance standards when they cannot be met.

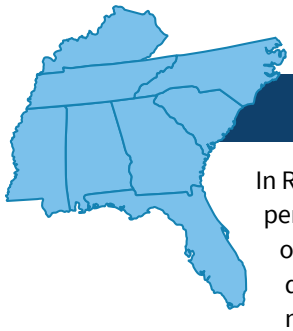
REGION 3

Two states in Region 3 allow fee-in lieu options in their Phase II permits. The **West Virginia** 2014 Phase II permit includes optional language that cites a wide range of potential programs for controlling stormwater off-site, including in-lieu payments, provided the funds are used for stormwater projects or for developing and implementing an off-site mitigation program. Cities may also develop "alternative methods" of managing the first 1" of rainfall. Applicants must submit technical justification that explains why on-site retention is infeasible and have this justification approved by the West Virginia Department of Environmental Protection.

The **District of Columbia's** 2011 Phase I permit allows for adjustments to its retention standard, but stipulates that the program contain specific criteria for determining "when compliance with performance standards may technically be met based on physical site constraints, or a rationale for why this is not necessary." The District also adopted tracking and accounting systems to ensure and verify that required stormwater practices stay in place and are adequately maintained.

The **Virginia** Stormwater Management Handbook provides an option for phosphorus offset fees. Fee amounts are typically driven by the market and are based on the phosphorus "deficit" on any given site (the difference between the target reduction and the actual site reduction after a designer makes his or her best effort to apply runoff reduction and pollutant removal practices).

Delaware sediment and stormwater regulations allow for "offsets," defined as "an alternate to strict adherence to the regulations including, but not limited to trading, banking, fee-in-lieu, or other similar program that serves as compensation when the requirements of these regulations cannot be reasonably met on an individual project basis."



REGION 4

In Region 4, the **Kentucky** 2010 Phase II permit allows permittees to adopt either an off-site mitigation or fee-in-lieu option for developers who demonstrate they cannot meet the on-site standard. Measures must be implemented at another location in the same sewershed/watershed as the original project.

Tennessee's 2016 Phase II permit allows MS4s to propose off-site mitigation and/or payment into a fund for public stormwater projects. Each MS4 must develop and apply criteria for determining the circumstances under which these alternatives will be available. A determination that the standards cannot be met on-site may not be based solely on the difficulty or cost of implementing measures and

must include multiple criteria. Examples include "lack of available area to create the necessary infiltrative capacity, a site use that is inconsistent with capture and reuse of stormwater, or physical conditions that preclude use of these practices." Mitigation must occur within the same HUC-12 watershed, if practicable, and treat a minimum of 1.5 times the portion water quality treatment volume not treated on site. Tennessee's language is unique in that it stipulates that MS4s may identify priority areas within the watershed in which stormwater mitigation projects are to be completed.

The non-regulatory **Georgia** Stormwater Management Manual allows for off-site mitigation or payment in lieu alternatives. The manual stipulates that "off-site project(s) will likely be initiated by the site developer, [with] the MS4 playing a coordinating and/or project approval role."

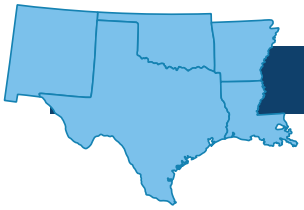
Mississippi's 2016 Phase II permit does not mention off-site compliance, but instead sets three criteria for determining when sites may claim a "waiver" from meeting permit standards.: (1) A potential for introducing pollutants into the groundwater exists unless pre-treatment is provided; (2) Preexisting soil contamination is present in areas subject to contact with infiltrated runoff; or (3) Sinkholes or other karst features are present.

REGION 5

In Region 5, **Ohio** provides optional language on mitigation, while **Minnesota** requires it. Ohio EPA may authorize off-site mitigation of post-construction control via its 2014 Phase II permit on a case-by-case basis, provided: (1) a maintenance agreement or policy is established to ensure operation and treatment in perpetuity; (2) the off-site location discharges to the same HUC-14 watershed unit; and (3) the mitigation ratio of the water quality volume is 1.5 to 1 or the water quality volume at the point of retrofit, whichever is greater. Requests for off-site mitigation must be received prior to receipt of the NOI application.

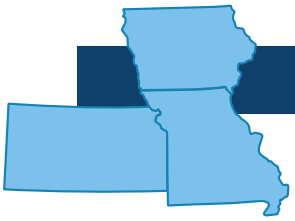
Minnesota's 2013 Phase II permit contains detailed, step-by-step requirements for each MS4 to implement an off-site mitigation program to meet total suspended solids (TSS) and/or total phosphorus (TP) pollutant reduction goals. Each MS4 "shall identify, or may require owners or operators of a construction activity to identify, locations where mitigation projects can be completed. The permittee's Regulatory Mechanism(s) shall ensure that any stormwater discharges of TSS and/or TP not addressed on the site of the original construction activity are addressed through mitigation." Further detailed requirements include a ranking system for selecting mitigation sites and stipulations for how payment to public funds shall be handled.

Michigan's individual permit application allows for off-site mitigation and in-lieu projects, but requires projects be completed within 24 months after the start of the original project site construction.



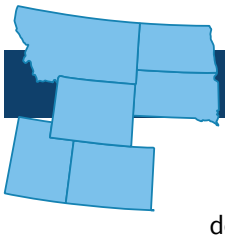
REGION 6

Few states using a narrative post-construction approach have adopted provisions for mitigation or fee-in-lieu options. In Region 6, where there is still a high prevalence of narrative standards, only **Texas** includes provisions for off-site compliance in its Phase II permit. The permit language states that, "the [MS4 post-construction] program must be established for private and public development sites. The program may utilize an off-site mitigation and payment in lieu of components to address this requirement."



REGION 7

Kansas allows for off-site compliance as appropriate, when waters of the state are affected by TMDL-regulated pollutants.



REGION 8

Montana's 2017 permit directs MS4s to develop and publish criteria for determining circumstances under which off-site treatment may be allowed, if desired. The criteria must be based on multiple factors, such as technical or logistic infeasibility (e.g., lack of available space), high groundwater or groundwater contamination, poorly infiltrating soils, shallow bedrock, prohibitive costs, and a land use that is inconsistent with capture and reuse or infiltration of stormwater. Determinations may not be based solely on the difficulty or cost of implementation and the MS4 must only allow off-site treatment after all on-site options have been evaluated and documented through a local formal approval process. Water must be managed within the same subwatershed.

REGION 9

California's 2013 Phase II permit allows permittees to propose alternative compliance options for multiple-benefit projects, including projects that may address any of the following, in addition to water quality: water supply, flood control, habitat enhancement, open space preservation, recreation, climate change.

REGION 10

Washington refers to off-site compliance in the state's two governing design manuals for eastern and western counties. Although the Stormwater Management Manual for **Eastern Washington** (2004) states that a fee-in-lieu is allowable under certain circumstances, the general stance of the state is that if a site cannot protect its water quality, it cannot be developed. The 2012 Stormwater Management Manual for **Western Washington** includes very similar language, stating that, "Ecology cautions local jurisdictions about the potential long-term consequences of allowing a fee-in-lieu of stormwater facilities. Sites that are allowed to pay a fee continue without stormwater controls. If it is determined, through future basin planning for instance, that controls on such sites are necessary to achieve water quality goals or legal requirements, the public may bear the costs for providing those controls."

*****NOTE:*** *Regional summaries only include information on states that reference market-based stormwater credits and incentives in their Phase II general permits. Not all states issue general permits. Information on additional state rules or programs was included where available*

Considerations – Off-site Compliance & Fee-in-Lieu Options

- ✔ Does your state have large areas that would limit on-site stormwater control, such as brownfields, shallow bedrock, elevated groundwater, steep slopes, poorly infiltrating soils or a land use that is inconsistent with capture and reuse or infiltration of stormwater?
- ✔ Does your jurisdiction allow for off-site compliance to meet stormwater requirements? Is there a demand or need for an alternative or off-site compliance path? Do you have an example?

Digging Deeper

- ✔ If your state or municipality requires builders and developers to demonstrate that on-site controls are infeasible, how is that infeasibility determined? Are the criteria understandable? Is the process predictable and timely? Who has final approval authority?
- ✔ Does your state or city have a mechanism to allow for in-lieu fee contributions as an alternative to on-site stormwater control? What legal documents transfer this responsibility in perpetuity? Who controls the funds? Are they dedicated to stormwater or do they go to a general fund?
- ✔ Are there other off-site stormwater control options? Typically, the more options offered, the better the chances that off-site compliance options will be cost-effective. Working with community leaders to identify meaningful components to benefit water quality concerns while balancing reasonable economic factors is an important starting point to a more flexible program.

Resources

- ✔ Working with the Market: Economic Instruments to Support Investment in Green Stormwater Infrastructure - Report by Willamette Partnership and Storm and Stream Solutions LLC summarizes how stormwater managers can spur cost-effective implementation of green stormwater infrastructure while tapping new sources to finance that investment.
- ✔ Off-site Storm Water Alternative Compliance Program – City of San Diego.

3.5: Market-based Mechanisms & Incentives

Roughly 40% of Phase II general permits provide language on market-based credits and incentives for stormwater management.

Figure 10. Phase II General Permits with Market-based Mechanisms (2017)

Data collected for this review was limited to Phase II general permit language. State or local rules may impose additional requirements. Tally does not include Maryland and Indiana since they defer to state rules; Iowa does not have a general permit; Alaska, Delaware, Idaho, Michigan, North Carolina and Oregon use individual permits.

- Mandatory Language
- Optional Language
- No Permit Condition Addressing this Topic

Roughly **40%** of Phase II general permits include language on credits or incentives for post-construction stormwater management, with only **2%** of states surveyed mandating that these programs be provided by the MS4. Development incentives can compel developers to use preferred BMPs, like LID, encourage compliance above and beyond existing standards, or in some cases, provide opportunities for developers to meet control obligations at lower cost. While stormwater trading is still in its infancy, many state programs offer other development incentives, such as one-time density bonuses or expedited permit review for those developers choosing to use green features.

In recent years, market-based trading of stormwater credits has gained momentum. Washington, D.C.'s Stormwater Retention Credit program is the first such trading program in the country, with units of retention serving as market "currency." Participating developers are responsible for meeting half of the required retention volumes on-site, but are allowed to purchase retention credits for the remaining volume from new or redevelopment projects that create credits by retaining *more* stormwater than required or by completing voluntary retrofits. A similar program has been established in Chattanooga, Tennessee, also driven by a retention requirement.

Most commonly occurring Phase II language related to stormwater credits and incentives:

- *Develop policies and ordinances that…direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space.*
- *Provide incentives for "green developers," such as expedited permit review, increased densities, reduced application fees, dedicated review team, lower stormwater fees, flexibility in design restrictions, reduced conventional stormwater requirements, adjustments to the required parking, and public recognition.*
- *Covered entities may include in the SWMP Plan provisions for development of a banking and credit system.*

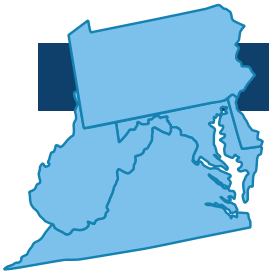
REGION 1

In EPA Region 1, no state Phase II permits contain explicit language on post-construction credits or incentives, but at least two states provide credits or incentive criteria in their design manuals. **Rhode Island**'s Phase II permit refers to its state design manual, which allows the state's water quality volume requirement to be waived or reduced when applying LID practices that disconnect areas of impervious surface, while **Vermont's** manual includes a list of six specific non-structural practices, which, if used properly, can result in the granting of "stormwater credit" to the site designer. A stormwater credit can reduce the required water quality and recharge storage volumes, thereby reducing the size and cost of other structural treatment practices. Bonuses may be provided for natural area conservation, disconnection of rooftop runoff, disconnection of non-rooftop runoff, stream buffers, grass channels, and environmentally

sensitive rural site design. **New Hampshire's** stormwater manual also contains language on credits for non-structural/source controls such as street sweeping or fertilizer reduction.

REGION 2

New York's 2015 permit and associated manual contains language on banking and credit/trading systems for new development in impaired watersheds and watershed improvement strategy areas to achieve pollutant reductions. The permit stipulates that any banking and credit system must ensure that offsets exceed the standard reduction by a factor of at least 2, be implemented within the same watershed, and address the relevant pollutant of concern in that watershed.



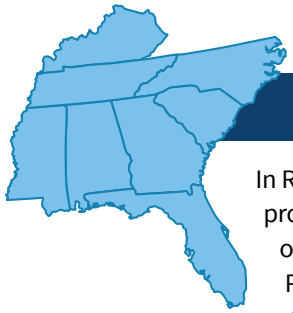
REGION 3

In EPA Region 3, the **District of Columbia's** 2011 Phase I permit requires a scoring system to encourage green infrastructure, including green roofs, permeable pavement, vegetated walls, tree preservation, and layering vegetation along streets and other visible areas. Finally, the permit recommends that the District consider credits for achieving other environmental goals, such as carbon sequestration, energy savings and air quality reductions in greenhouse gases. As mentioned above, in 2011, D.C. launched a stormwater retention credit trading program to meet these goals. Properties generate Stormwater Retention Credits (SRCs) for voluntary green infrastructure that reduces stormwater runoff, while property owners may trade SRCs in an open market to developers in need of assistance complying with the retention standard. Revenue creates incentives to install green infrastructure with multiple community benefits.[xx]

Virginia's 2013 permit provides optional language for pollutant trading and offsets, provided it is done in accordance with the requirements of the Virginia Stormwater Management Handbook. The handbook specifies that treatment requirements may be reduced if reductions are made to existing impervious cover during the redevelopment process. It also includes additional incentives to prevent creation of new or additional impervious cover at redevelopment sites.

A reduction of 0.2 inches from **West Virginia's** 2014 one-inch runoff reduction standard is allowed for projects considered valuable by the approving community, including redevelopment, brownfields redevelopment, high density, vertical density, and mixed-use and transit-oriented development. There are no specific criteria relating to how this standard is administered, and administration is left up to individual jurisdictions. **Pennsylvania's** 2013 Phase II permit provides for trading or credits as part of a TMDL implementation plan.

Delaware's sediment and stormwater regulations define "offset" as "an alternate to strict adherence to the regulations including, but not limited to trading, banking, fee-in-lieu, or other similar program that serves as compensation when the requirements of these regulations cannot be reasonably met on an individual project basis."

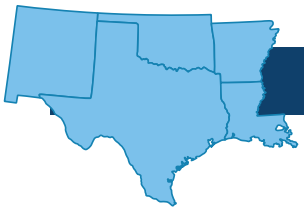


REGION 4

In Region 4, four states have optional provisions for post-construction credits or incentives. **South Carolina's** 2014 Phase II permit allows for adjustments to performance standards for new development or redevelopments that reduce the existing amount of impervious surface at the discretion of the MS4. The **Georgia** 2012 Phase II permit encourages MS4s to consider incentives for green infrastructure and LID practices in regulatory documents. In **Mississippi**, MS4s are also asked to report on policies and ordinances that direct growth to identified areas, protect sensitive areas, and maintain and/or increase open space. **Tennessee's** 2016 permit authorizes MS4s to reduce required water quality treatment volume by 20% for sites fitting certain criteria, awarding up to 50% in total credit. Criteria include redevelopment, vertical density (floor to area ratio of at least two, or at least 18 units per acre), and any other incentive identified by the MS4 and approved by the state in writing.

REGION 5

No states in Region 5 have language regarding incentives in their Phase II general permits. **Wisconsin's** 2015 Phase II permit does not contain provisions for market-based incentives, but does require MS4s to "promote" environmentally sensitive land development designs, including green infrastructure and LID.

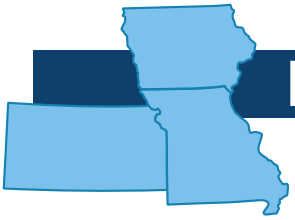


REGION 6

In Region 6, three states with Phase II permits provide optional provisions for post-construction credits and incentives.

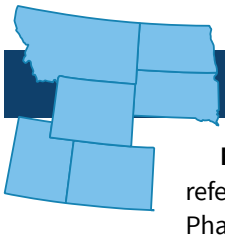
The **Arkansas** 2014 permit encourages communities to evaluate providing waivers or expedited site plan approval for developments using green infrastructure. In **Louisiana,** MS4 permittees are encouraged to "develop policies and ordinances that…direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space (including a dedicated funding source for open space acquisition), provide buffers along sensitive waterbodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation; as well as policies or ordinances that encourage infill development in higher density urban areas."

The **Oklahoma** 2015 Phase II permit encourages MS4s to offer a long list of incentives for "green developers," such as expedited permit review, increased densities, reduced application fees, dedicated review team, lower stormwater fees, flexibility in design restrictions, reduced conventional stormwater requirements, adjustments to the required parking, and public recognition.



REGION 7

Missouri is the only state in Region 7 with an optional provision to encourage growth in dense areas. The permit also mentions different methods to incentivize minimizing impervious surfaces.



REGION 8

Montana is the only state in Region 8 that references incentives. The Montana 2017 Phase II permit asks municipalities to describe how they will implement non-structural practices to encourage infill development in higher density areas, as well as areas with existing storm sewer infrastructure.

REGION 10

Washington 2014 East and West Phase II general permits do not provide specific suggestions for incentives.

Maryland Building Industry Association (MBIA) discusses incentives for flood and stormwater controls with Howard County officials.

Eva Birk

Considerations – Market-Based Mechanisms & Incentives

- ✔ Does your community currently provide market-based stormwater incentives or allow trading? Do you have examples of programs that work? Are there any changes that should be made to increase their use or acceptance?
- ✔ Are there specific constraints in your area that regularly make compliance with stormwater management requirements difficult? What is the nature of the constraints (e.g., space, geological factors, development patterns, resources, etc.)?

Digging Deeper

- ✔ What type of incentives would be most meaningful to builders and developers to compel the desired action (e.g., shorter permitting time frames, reduced permit fees, increased density, consolidated reviews, reduced stormwater volume requirements, etc.)? Which of these might be palatable to the municipality?
- ✔ Are there nearby entities that may be able to provide credits to help meet water quality needs at a lower cost, such as agriculture, larger development projects, or state or municipal entities, such as departments of transportation?
- ✔ What resources does the state or municipality have to put toward such a program? Are there other entities or mechanisms that could be used to staff or fund such an effort, such as conservation groups or public private partnerships?

Resources

- ✔ Environmental Finance Centers (EFCs) - These regional centers deliver technical assistance to help provide innovative solutions for financing investment in stormwater infrastructure.
- ✔ Getting to Green: Paying for Green Infrastructure - Financing Options and Resources for Local Decision-Makers –EPA report discussing various municipal funding sources for green infrastructure, including credits and incentives.
- ✔ Development Process Efficiency: Cutting Through the Red Tape – 2015 NAHB report focusing on strategies used recently—primarily since the end of the recession—to improve the efficiency of the land development review and approval process.

4: Decision-support Toolbox: Which Approach is Best for My State?

With clear communication and priority-setting up front, local preference and flexibility can be incorporated into a program that works well for all parties.

The next time your state or local MS4 permit is up for review, how will you determine which post-construction approach to advocate for? Climate, geography, land use patterns, local preference and priorities vary widely across the country. What worked in one state or region may not necessarily work in yours. The overall program goals from one community to another may be significantly different, as are resources and technical capabilities.

Because it would be impossible to endorse a "best" post-construction approach, this section provides a short discussion and decision-support tool to help developers brainstorm what approach will work best in their community.

There are four main considerations when choosing a post-construction approach

The overall goal of post-construction stormwater management is to prevent pollutants from being discharged into waterbodies over the long-term. Because states and localities have other responsibilities in addition to controlling stormwater runoff, determining how to do so becomes a balancing act among competing needs, priorities and resources. In the end, the decision often comes down to ease and cost off implementation, site influences, flexibility and results.

1. Ease and Costs of Implementation

Post-construction stormwater control programs take many forms. Before they are initiated, however, full consideration must be given to the range of elements and implementation options to ensure the program can be run using allocated resources and meet intended goals. Many of those considerations are related to the overall administration of the program, including structure, roles and responsibilities, how it is implemented in the field and how compliance is demonstrated and/or ensured. Equally important is the ability of stakeholders and the public to understand the program and how its success is measured.

As a first step, any state program must be designed to function using available resources. It makes little sense to develop a million-dollar program if the budget only contains $100,000. Because MS4s must ultimately administer portions of the program, states should consider not only their resources, but also the availability of municipal funding dedicated to post-construction stormwater control. If these coffers are minimal, states may want to choose an approach that is less costly and burdensome for MS4s to run, as they will be more likely to be successful. As this research found, several states require dischargers to demonstrate that retaining stormwater on-site is infeasible before they can use an off-site option. This takes time and effort from both the municipality and the landowner, so consideration should be given to how to make this process as simple and predictable as possible.

Similarly, how compliance is determined can have a significant impact on a program's administrative costs. Do landowners self-certify that they will comply? Are inspections required and if so, who conducts them? Does the municipality provide a "safe harbor" that assumes that if specific BMPs are installed and maintained, the stated reduction levels are met, or is periodic stormwater sampling required? Depending on who performs the sampling, this approach could add costs and burdens to the program.

Ease of implementation also stems from the readability of requirements. If those who must comply do not understand the rules or their obligations, MS4s must step in. Oftentimes these misunderstandings also result in problems in the field, which could lead to the need for more inspectors or inspections. In practice, programs in states that adopt combined treatment and retention approaches tend to be far more complex, which can make them more difficult to implement. Further, if combined treatment and retention programs are implemented through several legislative and regulatory mechanisms, confusion may ensue over how the different standards work together and what is exactly required from developers.

Conversely, the treatment-only and narrative approaches are often easier to implement. With a treatment-only approach, there are typically a set number of BMPs that can be used alone or in a series to demonstrate compliance.

Often, a state with a treatment approach will provide a BMP manual or spreadsheet tool to help in the design and implemen-tation of stormwater control features.

With a narrative approach, there are countless ways a development can "minimize water quality impacts," and methods can include structural and/or nonstructural BMPs. However, differing interpretations as to what is considered "minimizing" can make implementation tricky.

Finally, how the state or locality plans to measure and communicate the success of the program can have a bearing on which approach works best. If a state's biggest challenge is one related to water quantity, a retention-only approach may be the easiest way to demonstrate reductions and explain the benefits to the public in a meaningful way. Similarly, treatment-only or retention and treatment approaches might be best for areas that need to justify specific pollutant load reductions.

2. Site Factors

The ability to manage stormwater runoff on any given property is based on a combination of manmade and natural factors that affect both runoff quantity and quality. Prior land use, level of impervious surface coverage and soil compaction can all impact how much runoff can be retained on-site. Similarly, geography, depth to bedrock, rainfall patterns, and the extent of vegetative cover can also influence how runoff flows across and interacts with a site, potentially altering its form and its ability to effectively remove pollutants.

Recognizing this, selecting a state control approach is a fairly complex undertaking that must consider the realities of the state's landscape, stormwater runoff potential and pollutant sources. Because states also have other responsibilities and obligations (due to both federal and state mandates), they must also consider other specific issues that need to be addressed, such as protecting special waterbodies or complying with TMDL requirements. An important starting point is the assessment of state geography, geomorphology, notable resources areas, and rainfall and development patterns.

Because there are site conditions that can limit the use of certain BMPs used for treatment-only and retention-only approaches, states need to know how much land area is potentially affected by these conditions so that their chosen approach is not immediately deemed unworkable. For example, the retention-only approach can be difficult to implement if soils are not susceptible to infiltration, or located on top of unstable karst features. While a certain amount of retention may be achieved through evapotranspiration or capture or reuse, infiltration is the most commonly available method to achieve retention goals. If infiltration is not an option, fewer BMPs will be available to meet the expected runoff quantity reductions and a different approach may be a better fit. Likewise, in highly urbanized areas, land is at a premium, so BMPs that need space to properly function are not likely to be widely used. In these areas, states and localities must consider the feasibility and costs of alternatives. At a minimum, alternatives such as fee-in-lieu or credit trading should be promoted.

Climate conditions, snowmelt and rainfall patterns also have a significant impact on the efficacy of each of the four stormwater control approaches. For example, in arid areas known for low-frequency, high-precipitation events ("gully washers"), water quality devices must account for increased sediment loads associated with these storms. In areas with high snow melt potential, designs need to account for major combination rain/snowmelt events occurring early in the spring.

3. Consistency versus Flexibility

Recognizing the differing land conditions, resources, and expertise of small municipalities, states typically take one of two paths when directing the MS4s' stormwater control efforts – establishing a list of specific expectations, activities or processes that all MS4s must implement, or providing an overall expected outcome and allowing each municipality to tailor its program to meet this goal. While some may prefer having a checklist and knowing that, if each item has been completed, compliance is assumed, others like the flexibility of being able to tailor solutions to a specific project or property, or having the leeway to try new technologies or methods.

From an administration standpoint, it may appear easier to run a program that requires all of the municipalities within a state to do the same things, but given differing conditions, such an approach may not make sense because it may require certain MS4s to conduct activities that are unnecessary or inefficient.

On the other hand, a vague standard may allow post-construction stormwater requirements to vary greatly from one community to another within a state. In the 18 states relying on narrative (non-numeric) standards to comply with their Phase II requirements, municipal permittees have the maximum freedom and flexibility to implement post-construction stormwater measures as they see fit. Preserving a narrative-based standard at the state level can allow cities and towns to take into account local terrain, climate and soils, and continue to develop programs uniquely suited to their needs. Conversely, the inherent lack of specificity in most narrative approaches can also increase the probability of multiple interpretations of the standard being adopted across a state, inviting increased scrutiny from those who do not believe builders and developers are doing enough to control long-term stormwater runoff from their projects. It can also create problems if one MS4 opts to meet the requirements in a way that is perceived as more stringent than others, as groups could use that MS4's program requirements to advocate for the adoption of more stringent requirements statewide.

Colorado's experience illustrates some of the difficulties inherent in taking a narrative approach. Colorado previously required sites to "minimize the discharge of pollutants." Not surprisingly, the definition of "minimize" and methods of minimizing varied greatly from one community to another. MS4s required a range of controls to meet this standard, from capturing the 2-year storm event to establishing vegetative cover. Colorado ultimately rectified this lack of clarity by including a series of design standards in its latest small MS4 general permit, released in 2016. The new permit allows MS4s to determine which design standards should be implemented within their local programs. During an interview with the research team, the permit reviewer indicated that during the permit update process, MS4s requested continued flexibility, but developer organizations such as the HBA of Metro Denver requested more consistency. The state's menu of design standards is intended to satisfy both concerns by maintaining flexibility for permit holders while also limiting the interpretations of the term *minimize.* Hence, it is possible for a state to rely on a narrative standard and opt to make it either consistent or flexible (or, as in this example, consistent *and* flexible).

In summary, treatment-only, retention-only, and to some extent combined treatment and retention approaches tend to provide much more consistent results across an entire state, but can still be tailored to take on more flexibility if the state desires. However, inflexible design requirements and limited BMP choices can make some projects difficult or even infeasible. A more flexible approach that uses a performance-based standard can provide more leeway and better accommodate a range of BMP options.

4. Efficacy in Achieving Water Quality Benefits

Recognizing that the very reason for NPDES permits and associated standards is to improve water quality, it is important to determine whether your state's standard is really providing the best solution for actual results. This determination comes from a number of factors, including standard approach, permit requirements, BMP selection, level of compliance and enforcement.

How post-construction stormwater control programs are designed and run can have a significant impact on effectiveness. The structure of the requirements, for example, impacts the ability of builders and developers to understand and comply. The better the rules are understood, the better overall compliance and results. Choice can also be an important consideration. While state and local regulators are expected to recognize the challenges of addressing differing conditions, developers and landowners know best how local geography and land development trends impact which post-construction approaches are most likely to achieve optimal pollutant removal or runoff reduction in their area. As a result, the programs that take into consideration local site conditions and allow builders and developers to make informed choices regarding control methodologies may produce higher pollutant reduction efficiencies. Clearly, jurisdictions that encourage the installation of features that may ultimately have a high rate of failure due to local climate conditions not only fail the program, but they also pose liability and cost concerns. For example, design manuals that lack flexibility may push

developers into using highly complex and expensive proprietary devices to demonstrate compliance with treatment-based standards, but monitoring or ensuring these features continue to function can be problematic and cause the whole approach to backfire.

While the narrative approach is the most flexible and can be the easiest to implement, it may not lead to measurable differences in the quality of post-construction stormwater runoff unless the BMPs are tracked and pollutant reductions accounted for. When trying to account for pollutant load reductions associated with treatment-only approaches, one challenge is that most tracking programs do not often take into account existing and post-developed pollutant loads. Without knowing a starting pollutant load, it is impossible to quantify the benefit. In addition, removal efficiencies citied in most BMP manuals are assumed based on research that may or may not have been conducted in the particular state or under similar conditions. In reality, the removal capabilities of BMPs can vary greatly.

Retention-only and treatment and retention approaches can provide great water quality benefits due to the ability of retention-based features to actually capture, infiltrate and treat flows within site boundaries and to do so relatively naturally. These types of facilities, however, typically require larger land areas, so may not be optimal in highly-urbanized areas. As noted above, a strong maintenance, off-site compliance and/or credit-trading program may be necessary to ensure that these approaches are workable for all sites.

Addressing Concerns with Different Post-construction Approaches

Post-construction regulatory approaches often affect local development differently depending on each municipality's specific geographic, climate, and land use factors. This table is designed to help home builders associations (HBAs) assess whether a *proposed* stormwater standard, or even an existing standard that is up for modification will address top builder concerns. Where a yellow "caution" indictor is present, developers should consider whether or not their community can address the specific hurdles that may make the approach difficult to implement in the field. In these cases, it may be prudent to involve an environmental consultant or engineer to help work through specifics.

Approach is likely to address this concern

Caution – carefully consider factors before adopting this approach

Too many variations and factors exist to accurately predict feasibility of this approach

Table 3. Typical Builder/Developer Concerns with Different Post-Construction Approaches

Builder/ Developer Concern	Narrative	Water Quality (Treatment) Only			Retention Only	Retention & Treatment	Factors to Consider
		Treatment of Specified Volume of Runoff	Treatment of Specified Volume of Runoff for % Pollutant Removal	Site-based Load Limits			
Implementation in arid areas							• If requirements specify that stormwater runoff must be retained on-site, consider potential conflicts with downstream user rights. • In arid areas with flash flood concerns, ensure that features are designed such that they are not overwhelmed by infrequent rain events carrying high loads of sediment.
Implementation in areas with high precipitation							• The higher the annual precipitation rate, the more maintenance will likely be needed on structural BMPs. • Communities relying on a retention standard should ensure that down-stream areas will not be affected if practices fail.
Poor soil conditions, contamination concerns							• Developers may need to add soil amendments to improve infiltration on poorly draining sites, increasing the cost of BMP installation. • Contaminated sites or areas near leaking sanitary sewers may not be appropriate for infiltration. Builders in these areas should be allowed to use alternative approaches to meet a retention-based standard.
Implementation in urban infill							• In urban areas, developers may have less green space available to implement features to meet a retention-based standard. • Local codes should encourage, not prohibit practices that retain water in tight urban environments such as green roofs, permeable pavers and cisterns. • Communities may consider providing engineer/developer training and incentives to lower the cost of installing features on tight lots, or allow for off-site compliance or trading.
Implementation in greenfield development							• Implementing LID and green infrastructure on greenfield sites under a retention-based standard can minimize the need for traditional infrastructure (curb and gutter, centralized detention basins, wide road widths), which may lower total project cost. • If your community has adopted or is considering adopting a retention standard, determine whether developers will be allowed to use comprehensive site planning to minimize investment in structural controls.
Implementation on steep slopes							• Infiltration-only practices may be more difficult to implement on steep slopes. Designing around slope issues is possible, but may add extra project cost.

Endnotes

[i] 40 C.F.R. Part 122.26(b)

[ii] The District of Columbia's Phase I MS4 permit is included in this review because D.C. represents one of the most advanced municipal stormwater programs in the country and has lengthy experience administrating complex requirements that directly affect builders and developers, such as stormwater credit trading, green infrastructure, and off-site compliance. Its inclusion is intended to provide insight into the potential future direction of MS4 programs.

[iii] Gaffield, S. J., R. L. Goo, L. A. Richards, and R. J. Jackson. 2003. Public health effects of inadequately managed stormwater runoff. American Journal of Public Health 93(9):1527–1533.

[iv] Konrad, C .P. 2003. Effects of Urban Development on Floods. U.S. Geological Survey Fact Sheet FS-076-03. And National Research Council. 2008. Urban Stormwater Management in the United States. The National Academies Press, Washington, DC.

[v] 55 FR 47990 (November 16, 1990).

[vi] 64 FR 68722 (December 8, 1999).

[vii] Stormwater Phase II Final Rule: An Overview, U.S. EPA, Available online: https://www.epa.gov/npdes/stormwater-phase-ii-final-rule-fact-sheet-series

[viii] 81 FR 89326 (December 9, 2016).

[ix] 40 CFR § 122.34.

[x] ibid.

[xi] ibid.

[xii] See U.S. EPA. Green Infrastructure Program. Web. https://www.epa.gov/green-infrastructure

[xiii] *Georgia Stormwater Management Manual*, Atlanta Regional Commission, Aug. 2001. Web. http://www.atlantaregional.com/environment/georgia-stormwater-manual#original

[xiv] U.S. EPA. 2007. Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices. Nonpoint Source Control Branch (4503T). EPA 841-F-07-006.

[xv] New Hampshire Stormwater Manual. EPA, New Hampshire Department of Environmental Services, Comprehensive Environmental, Inc., December 2008. Web. http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20a.pdf

[xvi] Building Industry Association of Washington (BIAW). Shape NPEDS permit regs to work better for building. Building Insight. July 2013. Web. http://www.biaw.com/documents/shape_NPDES_regs_lid_dev_art4_7_13.pdf

[xvii] Brown, S. and Sanneman, C, 2017. Working with the Market: Economic Instruments to Support Investment in Green Stormwater Infrastructure. Retrieved from: www.willamettepartnership.org\publications

[xviii] Hydrologic Unit Codes or HUCs are standardized identification numbers used to describe watershed or drainage basins, among other features. As code numbers get higher (e.g., HUC-12 watershed vs. HUC-10, the code represents smaller and smaller units). For further description see Seaber, P.R., Kapinos, F.P., and Knapp, G.L., 1987, Hydrologic Unit Maps: U.S. Geological Survey Water-Supply Paper 2294, 63 p. Available: https://water.usgs.gov/GIS/huc.html.

[xix] Hinds, Juli Beth. 2015. *Evaluating the Real Estate Development and Financial Impacts of the San Diego Region's Post-Construction Standards and Alternative Compliance Program: A Multi-Disciplinary Effort*. Proceedings of 2016 Low Impact Development Conference. Portland, ME.

[xx] District of Columbia Department of Environment. 2017. Stormwater Retention Credit Trading Program. Online Resource: https://doee.dc.gov/src

Appendix Summary of State Standards

NAHB Survey of State Post-Construction Requirements - 2017

Note: Does not include changes in state rules after June 2016

CGP = Construction General Permit
DCIA = Directly Connected Impervious Area
MEP = Maximum Extent Practicable
MS4 = Municipal Separate Storm Sewer System
S-Rule = State Rule
S-Leg = State Legislation
TN = Total Nitrogen
TP = Total Phosphorus
TSS = Total Suspended Solids
WQv = Water Quality Volume

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
1	Connecticut	Manual (NR); Permit (CGP)	Connecticut Stormwater Quality Manual (non- regulatory); Construction General Permit Section 5(b)(2)(C)(i)	Redevelopment with ≥40% DCIA – retain 1/2 WQv (runoff from 1" rainfall) New development & redevelopment with <40% DCIA – retain WQv.	Reduce the average annual TSS loadings by 80% (assumed met my retention standard).	7/1/2017	6/30/2022
1	Maine	State-Rule	State Stormwater Management Law: 38 MRSA § 420-D; and Regulation: Chapter 500 & Chapter 502; General Small MS4 Permit MER041000		Provide treatment of no less than 95% of the impervious area and no less than 80% of the developed area. Treat 1" times impervious area plus 0.4" times pervious area.	7/1/2013	6/30/2018
1	Massachusetts	Permit (MS4)	Small MS4 Permit No. MAR041000; Massachusetts Stormwater Handbook; Wetlands regulations, 310 CMR 10.00 and 401 regulations, 314 CMR 9.00	Retain 1 inch multiplied by the impervious area and/or meet treatment standard	Remove 90% TSS AND 60% TP generated from impervious area	7/1/2018	6/30/2023
1	New Hampshire	S-Rule; Manual; Permit	Chapter Env-Wq 1500 Alteration of Terrain, Sections 1507 and 1508; New Hampshire Stormwater Manual	Retain 1 inch multiplied by the impervious area and/or meet treatment standard	Remove 90% TSS AND 60% TP generated from impervious area	7/1/2018	6/30/2023
1	Rhode Island	Manual	Rhode Island Stormwater Design and Installation Standards Manual, 2015		Capture and treat WQv equivalent to 1.2" rainfall runoff (90th percentile storm) Structural BMPs are generally required to achieve the following minimum average pollutant removal efficiencies: 85% removal of total suspended solids (TSS), 60% removal of pathogens, 30% removal of total phosphorus (TP) for discharges to freshwater systems, and 30% removal of total nitrogen (TN)	12/20/2003	12/19/2008 [DRAFT PERMIT UNDERWAY]

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
1	Vermont	S-Rule, Manual	10 V.S.A. 1264 Chapter 47, CHAPTER 18 STORMWATER MANAGEMENT RULE effective as of March 15, 2011.	Capture 90% annual storm events (0.9 inches across Vermont).	Remove 80 percent of the average annual post development total suspended solids load (TSS), and 40 percent of the total phosphorus (TP) load.	12/5/2012	12/5/2017
2	New Jersey	S-rule, Manual	Technical criteria outlined in: Stormwater management rules, NJAC 7:8; 7:14 A; 5:21. New Jersey Stormwater Best Management Practices Manual (Regulatory Document).	Maintain groundwater recharge volume or infiltrate runoff for 2- year storm (post development volume to predevelopment volume)	For redevelopment, 50% TSS reduction or equivalent to existing BMP; 80% TSS removal for new IC	3/1/2009	2/28/2014 [DRAFT PERMIT UNDERWAY]
2	New York	Manual, Permit (MS4)	New York State Stormwater Manual (Manual, Chapter 4); SPDES General Permit for Stormwater Discharge from MS4s, GP-0-15-003	RR for post development volume (0.8" – 1.2") to replicate predevelopment hydrology	Remaining WQv not retained, must be treated; removal efficiency equivalent to the Department's performance criteria (80% TSS removal and 40% phosphorus removal)	5/1/2015	4/30/2017 [DRAFT PERMIT UNDERWAY]
3	Delaware	S-Rule	7 Del. C. Ch. 40 establishes Delaware's sediment and stormwater program; Delaware Sediment and Stormwater Regulations, State Manual 3.06.2 Post Construction Stormwater BMP Standards and Specifications; Currently individual Small MS4 permits; Draft Phase II General Permit expected to be released in 2016.	RR for 1-year event (post-development runoff volume to predevelopment volume) or 0% effective IC	Remaining WQv not retained must be treated	Individual Permits	Individual Permits [DRAFT PERMIT UNDERWAY]
3	Maryland	S-Rule, Manual	Code of Maryland Regulations (COMAR) 26.17.02; Maryland Stormwater Design Manual. The Maryland Environment Article, Title 4, Subtitle 2, Annotated Code of Maryland establishes a statewide stormwater management program	Runoff Reduction using Environmental Site Design to the Maximum Extent Practicable (MEP) for 1-year storm.	Manage 0.9" / 1" of rainfall; 40% phosphorous and 80% TSS reduction required. Assumed to be met if on-site volume control requirements are met	4/14/2003	Admin. Continued [DRAFT PERMIT UNDERWAY]
3	Pennsylvania	S-Leg	Act 167 and Pennsylvania Stormwater Best Management Practices manual (nonregulatory), developed in 2006.	For sites < 1 acre; Remove 1" of runoff from IC All sites: No post-development runoff volume increase for the 2-year storm	Sites <1 acre: Capture 2" of runoff from contributing IC. Achieve an 85% reduction in TSS, an 85% reduction in phosphorus loads, and a 50% reduction in NO3-N loads	3/15/2013	3/16/2018

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
3	District of Columbia	Permit (MS4), S-Rule, Manual	Phase I MS4 Permit, Chapter 5 of Title 21, and Chapter 31 of Title 20, District of Columbia Municipal Regulations (DCMR) and DC Stormwater Guidebook.	Retain 1.2" (90th percentile storm) from a 24-hour storm with a 72-hour antecedent dry period through evapotranspiration, infiltration and/or stormwater harvesting and use.	Narrative	9/30/2011	10/7/2016 [DRAFT PERMIT UNDERWAY]
3	Virginia	S-Rule, Manual	Technical criteria outlined in: VSMP Regulations Part II (4VAC50-60-40); Virginia Stormwater Management Handbook, also Virginia Stormwater Management Act (Article 2.3 (§ 62.1-44.15:24 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia) and the Virginia Stormwater Management Program (VSMP) Regulations·(9VAC25-870);	Narrative	New development shall not exceed 0.41 lbs P/acre/yr; Redevelopment: 20% (sites >1 acre) 10% (sites ≤1 acre) P reduction from existing condition	7/1/2013	6/30/2018
3	West Virginia	Permit (MS4)	Existing MS4 Stormwater Permit WV0116025 Issued 2014	Keep and manage on site 1' rainfall from 24 hour storm proceeded by 48 hours of no rain.		8/1//2014	8/11/2019
4	Alabama	Permit (MS4)	NPDES Phase II MS4 Permit and state regulation: Code of Alabama 1975, §§ 22¬22-1 to 22-22-14 and §§ 22-22A-1 to 22-22A-16 et seq., as amended	Narrative –Ensure to MEP that volume and velocity of pre-construction stormwater runoff not significantly exceeded	Narrative	10/1/2016	9/30/2021
4	Florida	S-Rule	NPDES Phase I and Phase II MS4 permits reference the state stormwater rules as an equivalent state program for stormwater discharges from new development and redevelopment. State Stormwater: Chapter 373, Part IV and Chapter 403, Florida Statute (F.S.) combine wetland resource permitting and stormwater management permitting into an "Environmental Resource Permit" regulation	Must meet predevelopment volume in closed basins only	Depends on Water Management District – From first 1/2 inch runoff to 1.25 times percent imperviousness plus an additional 1/2 inch of runoff for online retention systems. Section 62-40.432,F.A.C. At least 80 percent reduction of the average annual load of pollutants that would cause or contribute to violations of state water quality standards.	5/1/2003	4/30/2008 [DRAFT PERMIT UNDERWAY]
4	Georgia	Permit (MS4); Manual	NPDES Phase II MS4 Permit requires adoption of the State Stormwater Manual - GA's Volume 2: Technical Handbook (2001).;For those permittees located in the 11-county coastal management program service area the adopted manual must include the applicable parts of the Coastal Stormwater Supplement (CSS) to the GSMM, specifically the performance standards		Treat runoff from 85% of storms (1.2" rainfall)	12/6/2012	12/5/2017 [DRAFT PERMIT UNDERWAY]
4	Kentucky	Permit	Phase II MS4 permit - KYG200000		Treat runoff from 80th percentile precipitation event runoff (0.75") Remove 80% average annual TSS	3/1/2010	2/28/2015

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
4	Mississippi	Permit (MS4)	General MS4 Permit No. MSRMS4 Mississippi's Phase II Small Municipal Separate Storm Sewer System (MS4) Guidance Manual (2002, non-regulatory)	Develop site designs; infiltrate, evapotranspire, harvest or use first inch of rainfall		3/18/2016	2/28/2021
4	North Carolina	S-Leg, Manual	State-wide stormwater manuals (regulatory); Session Law 2006-246. General permits are divided between 80 "non-coastal" counties and coastal counties.		Non-coastal: Treat runoff from 1" rainfall; Coastal: Treat runoff from 1.5" rainfall Remove 85% average annual TSS.	Individual Permits Only	Individual Permits Only
4	South Carolina	Permit (MS4), Manual	SC BMP Guidebook; Revised in 2005, New 2013 permit contains performance standards in Part 4.2.5.2; Session Law 2006-246; Session Law 2008-211); 15A NCAC 02H .1000; 15A NCAC 2B .100 and .200	1,000 ft from shellfish waters, retain 1.5" of rainfall	Design, install, implement, and maintain stormwater control measures that approximate pre-development conditions to the MEP and protect water quality. 2005 Manual presents three different first flush volumes (.5, 1, and 1.5')	1/1/2014	12/31/2018
4	Tennessee	Permit (MS4)	Phase II MS4 general permit - TNSOOOOOO	First inch of every rainfall event generated by impervious surface must be 100% managed with no runoff being discharged to surface waters. For projects that cannot meet 100% of the runoff reduction requirement unless subject to the incentive standards, the remainder of the stipulated amount of rainfall must be treated prior to discharge with a technology reasonably expected to remove 80% TSS		10/1/2016	9/30/2021
5	Illinois	Permit (MS4)	General NPDES Permit No. ILR40;References 2002 Illinois Manual and NPDES Permit ILR 10 (ILLINOIS CGP)	Narrative	Narrative	3/1/2016	2/28/2021
5	Indiana	S-Rule, Manual	Indiana Stormwater Water Quality Manual; The general permit rule, referred to as Rule 13, provides permit coverage for most Phase II MS4 entities		Phase I only: Treat runoff from first 1" of precipitation; Phase II – Specific reduction percentages and timetables must be identified by the MS4	2003	Permit by Rule [DRAFT PERMIT UNDERWAY]
5	Michigan	Permit (MS4)	Michigan DEQ is currently issuing individual permits to all regulated MS4s (both Phase I and Phase II MS4s)	Post-construction rate and volume to not exceed pre-development for all storms up to 2-yr, 24-hr storm	Treat first inch runoff or 90% of all runoff-producing storms (to reduce TSS load by 80% or concentration less than 80 mg/L)	Individual Permits Only	Individual Permits Only

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
5	Minnesota	Permit (CGP/MS4); Manual	NPDES/SDS Construction Stormwater General Permit No. MNR100001 (August 2013); the NPDES/SDS MS4 General Permit No. MNR040000 (August 2013);; Minnesota Stormwater Manual	1 inch retention on-site (CGP)	No net increase from pre-project conditions (on an annual average basis) of TSS, TP (MS4)	8/1/2013	7/31/2018
5	Ohio	Permit (CGP/MS4)	Construction General Permit and Phase II MS4 General Permit - OHQ000003. MS4 general permit requires ordinance or other regulatory mechanism to be, at a minimum, equivalent with the technical requirements set forth in the Ohio EPA NPDES General Storm Water Permit(s) for Construction Activities applicable for the permit area.(Standards in CGP have not changed since 2011).		Treat WQv equivalent to 0.75" rainfall runoff volume	9/11/2014	9/10/2019
5	Wisconsin	S-Rule	About 220 municipalities in Wisconsin are currently required to have a Municipal Separate Storm Sewer System (MS4) permit under NR 216, Wis. Adm. Code Chapters NR 151, 153, and 155 and 216. These Chapters authorize WPDES Permit No. WI-S050075-1Post construction standard in: subch. III of ch. NR 151 (WI Administrative code)	Infiltrate runoff to achieve 60-90% of predevelopment volume based on IC level.	80% TSS reduction required, or maximum extent practicable	5/1/2014	4/30/2019
6	Arkansas	Permit (MS4)	Phase II MS4 general permit ARR040000	Narrative	Narrative	8/1/2014	7/31/2019
6	Louisiana	Permit (MS4)	Louisiana's Water Quality Regulations (LAC 33: Chapter IX) authorizes stormwater discharges in compliance with the NPDES MS4 General Permit	Narrative	Narrative	3/1/2013	2/28/2018
6	New Mexico	Permit (MS4)	Phase II MS4 general permit - US EPA NPDES Permit (Permit Nos: NMR040000, NMR04000I)	Narrative. Draft General MS4 permit requires permittees to manage on-site the 90th percentile storm event discharge volume associated with new development sites and 80th percentile storm event discharge volume associated with redevelopment sites		7/1/2007	6/30/2012 [DRAFT PERMIT UNDERWAY]
6	Oklahoma	S-Rule, Permit (MS4)	NPDES Phase II Permit (OKR04)	Narrative	Narrative	11/1/2015	10/31/2020
6	Texas	Permit (MS4)	NPDES Phase II MS4 General Permit (Permit No. TXR040000)	Narrative	Narrative	12/31/2013	12/12/2018 [DRAFT PERMIT UNDERWAY]
7	Iowa	Permit (MS4)	Iowa stormwater management manual (non-regulatory)	Narrative	Narrative	Individual Permits	Individual Permits

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
7	Kansas	Permit (MS4)	Guidance Manuals have been developed individually by the Phase I municipalities, and a consortium of 19 Phase II municipalities. There is no State level guidance manual	Narrative	Narrative	1/1/2014	12/31/2019
7	Missouri	Permit (MS4)	NPDES Phase II Small MS4 General Permit MO-R040000	Narrative	Narrative	10/1/2016	9/30/2021
7	Nebraska	Permit (MS4); S-Rule	NPDES Permit Number: NER210000, NER300000; Nebraska Administrative Code, Title 119 - Nebraska Department Of Environmental Quality, Chapter 10 - *NPDES Regulations Applicable To Storm Water Discharges*	Narrative	Narrative	10/1/2009	9/30/2014
8	Colorado	Permit (MS4)	None. Treatment standards are determined by individual communities. Authority: NPDES Phase II Permit COR-070000, COR-090000 & COR-080000	Infiltrate WQ control volume (80th percentile storm event)	Treat 80th percentile storm event or reduce TSS to below 30mg/L	4/6/2016	6/30/2021
8	Montana	Permit (MS4)	NPDES Phase II MS4 general permit No. MTR04-0000	Infiltrate, evapotranspire, or capture for reuse runoff from first 0.5”		1/1/2017	12/31/2021
8	North Dakota	Permit (MS4)	NPDES Phase II MS4 general permit No. NDR04-0000		Treat 0.5” runoff from IC. See permit Appendix for more detail.	4/1/2016	3/31/2021
8	South Dakota	Permit (MS4)	NPDES Phase II MS4 general permit	Narrative	Narrative	1/1/2003	12/31/2007
8	Utah	Permit (MS4)	NPDES Phase II MS4 general permit No. UTR090000	Retain on-site the 90th percentile storm event		3/1/2016	2/28/2021
8	Wyoming	Permit (MS4)	NPDES Phase II MS4 general permit No. WYR04-0000	Narrative	Narrative	12/1/2008	9/30/2013
9	Arizona	Permit (MS4)	NPDES Phase II MS4 general permit No. AZG2002-002	Narrative	Narrative	9/30/2016	9/29/2021
9	California	Permit (MS4/CGP)	Varies; each MS4 or regional co-permitees have adopted reference and technical guidance documents: MS4 Permit Phase I and Phase II (NPDES General Permit No. S000004 - E.12.e(ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment)	Retain volume from 85th percentile storm event		7/1/2013	6/30/2018
9	Hawaii	Permit (MS4), S- Rule	NPDES Phase II MS4 general permit, State Rule, HAR Chapter 11-55, Appendix K	Narrative	Narrative	12/6/2013	12/6/2016
9	Nevada	Permit (MS4)	NPDES Phase II General Permit No. NVS040000		80% annual runoff volume treatment	7/6/2010	7/5/2015

EPA Region	Program	Standard Source Type	Standard Source Name	Volume-Based/ Retention	Treatment	General Permit Effective Date	General Permit Expiration Date
10	Alaska	Permit (MS4)	Anchorage Phase I MS4 permit (Part II.B.2) 2010, Fairbanks individual Phase II 2013	Retain first 0.52 inches of rainfall from 24 hr event preceded by 48 hrs of no precip. -This standard is found in Anchorage Phase I (2010) permit only. Fairbanks Phase II individual permit is narrative only.	Narrative (Fairbanks Phase II)	Individual Permits Only	Individual Permits Only
10	Idaho	Permit (MS4)	Individual Phase I, Phase II MS4 permits	Narrative	Narrative	Individual Permits Only	Individual Permits Only
10	Oregon	Permit (MS4)	Currently, there are 15 individual Phase II Municipal Separate Storm Sewer System (MS4) permits that obtained individual permit coverage by being Automatically Designated. Minimum thresholds are established for Phase I permittees regulating 90% of all new or replaced impervious surfaces (DEQ staff, 10/21/2010).	Narrative	Narrative	Individual Permits Only	Individual Permits Only [DRAFT GENERAL PERMIT UNDERWAY]
10	Washington	Manual, Permit (MS4)	Eastern Washington, Western Washington Phase II MS4 general permits (2), Manuals. "The ordinance or other regulatory mechanism shall require project proponents and property owners to adhere to the minimum technical requirements in Appendix 1 " (EW Permit page 22)	Infiltrate, disperse, and retain onsite to Maximum Extent Practicable (MEP)	Volume predicted from 6 month 24 hr storm OR 91st percentile 24 hr runoff volume indicated by continuous runoff model. Max flow rate where 91% of runoff volume (determined by model) will be treated. Water quality design volume: Basic runoff treatment (to remove solids) is required for all new development projects creating 5,000 square feet or more of pollutant-generating impervious surface (PGIS) areas.	8/1/2014 (Eastern) 8/1/2014 (Western)	7/31/2019 (Eastern) 7/31/2018 (Western)

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