[DRAFT] Regulatory Impact Analysis

Stormwater Management Rules: 15A NCAC 2H .0100 and 2H .1000

- **Permit Administration**
- **NPDES MS4 & Urbanizing Areas**
- **High Quality/Outstanding Resource Waters**
- **Coastal Stormwater**
- **Universal Stormwater Management Program**
- **General Permits**
- **Fast Track Permitting Process**
- **New Stormwater Technologies Program**
- **Minimum Design Criteria**

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Purpose of this Regulatory Impact Analysis

One of the key purposes of this Regulatory Impact Analysis (RIA) is to demonstrate in a systematic way that the proposed changes to the Sections 2H .0100 and 2H .1000 rules impose a less stringent burden on regulated persons. In completing this RIA, the DEQ also wishes to communicate to the regulated persons and the public, in general, about how these proposed rules may affect them economically on one-year and five-year timeframes.

It is not a goal of this RIA to be as detailed as a Fiscal Note. This is in accordance with a recent legislative directive. Section 1.6.(a) of Session Law 2015-286 states: "If a rule is readopted without substantive change, or if the rule is amended to impose a less stringent burden on regulated persons, the agency is not required to prepare a fiscal note as provided by G.S. 150B-21.4." Several draft rules within this rulemaking package propose individual provisions that are more stringent than the baseline. However, each proposed rule as a whole, as well as the overall rule package, is less stringent than the baseline.

The term "baseline" is used in every chapter of the "Analysis by Rule" section of this RIA. From the U.S. EPA *Guidelines for Preparing Economic Analyses*: "A baseline is defined as the best assessment of the world absent the proposed regulation or policy action. . . A policy action includes both regulations and the issuance of Best Management Practices (BMPs) or guidance documents, which do not carry the same force as a regulation, but do affect the decisions of firms and consumers. . . The baseline serves as a primary point of comparison for an analysis of a proposed policy action."[1]

For the purpose of this RIA, the following items are considered to comprise the baseline for this rulemaking package:

- The current version of the Sections 2H .0100 and 2H .1000 rules as of December 1, 2015;
- Current NC general statute and session law;
- Policies that are currently implemented in the DEQ Stormwater Permitting Program via authority granted under G.S. 215.1(b) which requires the Environmental Management Commission to issue permits that will prevent significant increases in pollution from permitted activities. To achieve this purpose, the Commission sets forth permit conditions with which the permittee must comply. These conditions can include provisions not specifically contained in rule or statute but established through research and engineering standards as needed technical components; and
- The current version of the NC Stormwater BMP Manual as of December 1, 2015. Permittees must follow the specifications of the BMP Manual or propose an equivalent alternative in order to receive a permit for their activity. The current rules allow for alternative designs to achieve compliance with stormwater management requirements. As alternative designs have become more widely used over time, DEQ has established a process to allow the regulated community to take advantage of these alternatives by incorporating technical updates into the BMP Manual. Public comments on changes to the BMP manual are solicited through a formal public notice process before being incorporated into the BMP Manual.

[1] US EPA *Guideline for Preparing Economic Analyses*, http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-05.pdf/$file/EE-0568-05.pdf

Why and How these Rules Were Written

This package of rules has been proposed by the Environmental Management Commission to meet the regulatory requirements associated with Session Law 2013-82 (House Bill 480) and G.S. 150B-21.3A.

S.L. 2013-82 (HB 480) Fast-Track Permitting and MDC

S.L. 2013-82 requires DEQ to convene a stakeholder team that includes industry experts, engineers, environmental consultants, faculty from the University of North Carolina and other stakeholders to develop minimum design criteria (MDC) for stormwater management. In summary, S.L. 2013-82 tasks the MDC Team with the following:

1) To consult with DEQ in developing MDC that encompass all requirements for siting, design, construction and maintenance of stormwater best management practices (BMPs). The MDC shall be developed with the goal of generating state stormwater permits that comply with state water quality standards. DEQ shall submit its recommendations to the Environmental Review Commission by September 1, 2014. (S.L. 2014-120 extended this deadline to February 1, 2015 with progress reports due to the ERC by September 1, 2014 and December 1, 2014); and

2) To consult with the N.C. Environmental Management Commission (EMC) in developing a fast-track permitting process for issuing state stormwater permits without a technical review when all best management practices comply with all MDCs and the permit application is prepared by a qualified individual. The EMC shall adopt a fast-track permitting rule no later than November 1, 2016.

The MDC stakeholder team is comprised of 25 members who represent environmental consultants, the construction industry, local governments, university faculty, environmental groups, a soil scientist, a landscape architect, NCDOT and DEQ. (See MDC Team Charter for a list of team members.) The team has met for three to five hours once a month between March 2014 and May 2015 and has invested time between each meeting reading and preparing comments.

Despite the broad composition of the team, team members have been successful in reaching consensus and it has been a great opportunity to review and update stormwater design standards with a diverse and knowledgeable group of experts. In many cases, the work products of the MDC Team remove outdated design standards that are no longer believed to protect water quality. The efforts of the MDC Team are documented on the MDC Team web site at: http://portal.ncdenr.org/web/lr/state-stormwater/mdc-team.

The first achievement of the MDC Team was the approval of a charter to establish procedures and protocols. The second was to define "Minimum Design Criteria" (MDC). The team defined MDC as follows: *Design standards that must be met to ensure that a stormwater treatment system functions in perpetuity to protect water quality standards and achieves the pollutant removal rates associated with the system.*

The MDC Team decided that MDC apply to stormwater treatment systems regardless of the geographical location of the system, the stormwater program requirements to which it is subject or whether the system is being reviewed under the fast-track or regular review process.

The MDC Team developed MDC for the following:

- All Stormwater Control Measures
- Wet ponds
- Stormwater wetlands
- Infiltration systems
- Bioretention cells
- Sand filters
- Rainwater harvesting
- Green roofs
- Permeable pavement
- Swales
- Disconnected impervious surfaces
- Level spreader-vegetated filter strips

DEMLR staff is incorporating the MDC into two very important products:

1) Updates to the NC Stormwater Technical Guidance Manual (formerly known as the "NCDENR Stormwater BMP Manual") so that it is consistent with the MDC developed by the MDC Team; and
2) Rule-making to codify the MDC into the 15A NCAC 2H .1000 rules, which govern the design, construction and maintenance requirements for stormwater control measures.

G.S. 150B-21.3.A Periodic review and expiration of existing rules.

In addition to the new proposed MDC and Fast-Track Permitting rules, this proposed rulemaking package includes updates to all existing stormwater rules in accordance with G.S. 150B-21.3A, "Periodic Review and Expiration of Existing Rules", which directs state agencies to review and update their rules every 10 years. As a result, the rules are being readopted in accordance with G.S. 150B-21.3A(d). In general, the proposed changes to existing rules improves consistency between programs while reducing repetition, incorporates updated technology and design standards, and codifies long-standing permitting program requirements. It also includes numerous changes that are technical in nature, such as updating references, renumbering, and reorganizing.

Summary of Costs and Benefits

As measured from the baseline conditions, the Regulatory Impact Analysis of the proposed rulemaking package indicates that each proposed rule as a whole, as well as the overall rule package, imposes a less stringent burden on regulated persons. Section 1.6.(a) of S.L. 2015-286 states: "If a rule is readopted without substantive change, or if the rule is amended to impose a less stringent burden on regulated persons, the agency is not required to prepare a fiscal note as provided by G.S. 150B-21.4." As such, a fiscal note has not been prepared for this rulemaking package.

The following chapters of this Regulatory Impact Analysis support this conclusion and provide a detailed analysis for proposed changes, including cost and benefit estimations where possible. Tables 2 through 5 provide summaries of cost and benefit estimations by rule and affected party projected for the year 2017. This analysis indicates that the estimated total annual economic impacts would be $28 million (net benefit statewide) for 2017. This estimate is based on numerous datasets, including state and local permitting data, research on costs of stormwater control measures, and statewide land values. The actual benefit to the regulated community will depend on many variables, but it will be particularly dependent on the rate and pattern of new development. In addition, the total benefit would be lower if new development projects choose not to incorporate some or all of the updated, less stringent MDC.

Although this estimated benefit would be considered a "substantial" economic impact, a fiscal note was not prepared for this proposed rulemaking package because it imposes a less stringent burden on regulated persons and is therefore not required to prepare a fiscal note as provided in G.S. 150B-21.4.

Table 1: Summary of Rules in the Proposed Rule-Making Package

Rule		Proposed Action	Fiscal Impact?	Env Impact?
2H .0126	Stormwater Discharges	Readopt w/Amendment	No	No
2H .0150	Definitions: NPDES MS4 Stormwater	Readopt w/Amendment	No	No
2H .0151	NPDES MS4 Stormwater: Designation and Petition Process	Readopt w/Amendment	No	No
2H .0152	Development in Urbanizing Areas	Repeal	No	No
2H .0153	NPDES MS4 Stormwater: Program Implementation	Readopt w/Amendment	No	No
2H .0154	Post-Construction Practices	Repeal	No	No
2H .1001	Post-Construction Stormwater Management: Purpose and Scope	Readopt w/Amendment	No	No
2H .1002	Definitions	Readopt w/Amendment	No	No
2H .1003	Requirements that Apply to All Subject Projects	Readopt w/Amendment	No	No
2H .1004	*Repealed*	--	--	--
2H .1005	Stormwater Requirements: Coastal Counties	Repeal	No	No
2H .1006	Stormwater Requirements: HQW	Repeal	No	No
2H .1007	Stormwater Requirements: ORW	Repeal	No	No
2H .1008	Design of Stormwater Management Measures	Repeal	No	No

2H .1009	Staff Review and Permit Preparation	Repeal	No	No
2H .1010	Final Action on Permit Applications	Repeal	No	No
2H .1011	Modification and Revocation of Permits	Repeal	No	No
2H .1012	Delegation of Authority	Repeal	No	No
2H .1013	General Permits	Repeal	No	No
2H .1014	Stormwater Management for Urbanizing Areas	Repeal	No	No
2H .1015	Urbanizing Areas Definitions	Repeal	No	No
2H .1016	Development in Urbanizing Areas: Applicability and Delineation	Readopt w/Amendment	No	No
2H .1017	NPDES and Urbanizing Areas: Post-Construction Stormwater Management	Readopt w/Amendment	No	No
2H .1018	Urbanizing Areas: Delegation of Stormwater Management Program	Adopt	No	No
2H .1019	Coastal Counties	Adopt	Savings	Improve
2H .1020	Universal Stormwater Management Program	Readopt w/Amendment	No	
2H .1021	Non-Coastal County HQW and ORW	Adopt	Savings	Improve
2H .1022 - .1029	*Reserved for future codification*	--	--	--
2H .1030	Stormwater Requirements: Oil and Gas Exploration and Production	*Not part of the current rules review cycle*		
2H .1031	New Stormwater Technologies Program	Adopt	No	No
2H .1040	Permit Administration	Adopt	No	No
2H .1041	General Permits	Adopt	No	No
2H .1042	Standard Permitting Process	Adopt	No	No
2H .1043	Fast Track Permitting Process: Authorization to Construct	Adopt	No	No
2H .1044	Fast Track Permitting Process: Final Permit	Adopt	No	No
2H .1045	Requirements for Permit Transfers and Renewals	Adopt	No	No
2H .1050	MDC for all Stormwater Control Measures	Adopt	No	No
2H .1051	MDC for Infiltration Systems	Adopt	Savings	Improve
2H .1052	MDC for Bioretention Cells	Adopt	Savings	Improve
2H .1053	MDC for Wet Ponds	Adopt	Savings	No
2H .1054	MDC for Stormwater Wetlands	Adopt	Savings	Improve
2H .1055	MDC for Permeable Pavement	Adopt	No	No
2H .1056	MDC for Sand Filters	Adopt	Savings	Improve
2H .1057	MDC for Rainwater Harvesting	Adopt	No	No
2H .1058	MDC for Green Roofs	Adopt	No	No
2H .1059	MDC for Level Spreader-Filter Strips	Adopt	No	No
2H .1060	MDC for Disconnected Impervious Surface	Adopt	No	No
2H .1061	MDC for Treatment Swales	Adopt	No	No
2H .1062	MDC for Dry Ponds	Adopt	No	No

Table 2: Estimated 2017 Net Costs and Benefits Listed by Rule (X $1,000)

Note: Only includes rules with quantifiable costs and benefits.

		A Development Community			B Owner	TOTAL
		Pre-const	Land	Const	Maint	
2H .1019	Coastal Counties	0	-109	-132	0	-241
2H .1021	Non-Coastal County HQW and ORW	0	-34.6	-80.2	0	-114.8
2H .1051	MDC for Infiltration Systems	-146	-139	-662	-7.5	-959
2H .1052	MDC for Bioretention Cells	0	-296.5	-1,558	-145	-2,000
2H .1053	MDC for Wet Ponds	0	-4,886	-16,589	-450	-21,925
2H .1054	MDC for Stormwater Wetlands	0	-1,174	-1,494	-41	-2,709
2H .1056	MDC for Sand Filters	-66.3	0	0	-9.3	-75.6
TOTALS		-212	-6,639	-20,515	-653	**-28,000**

Table 3: Estimated Costs and Benefits Listed by Regulated Party (X $1,000)

	Projected for 2017
Development Community	-27,366
Owners	-653
Local Governments *	0
State Government *	0
NC Department of Transportation **	0
TOTALS	**-28,000**

* See Table 4 for an explanation of the non-quantifiable costs and benefits to the state government and local governments.

** This rulemaking does not affect the environmental permitting process at NCDOT nor does it affect NCDOT projects.

Table 4: Costs and Benefits to the State Government and Local Governments

2H .1019	**Coastal Counties** This rule is implemented solely by the DEQ, so there will not be any costs for local governments associated with the rule updates. For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for projects subject to the Coastal Counties stormwater rule more streamlined and efficient.
2H .1021	**Non-Coastal County HQW and ORW** This rule is implemented solely by the DEQ, so there will not be any costs for local governments associated with the rule updates. DEQ already reviews projects for compliance with the existing HQW and ORW rules, and this change will not add any additional time or complexity to regulatory reviews.
2H .1051	**MDC for Infiltration Systems** This rule updates design standards for infiltration systems throughout the entire state. For local governments that are implementing NPDES stormwater programs, there will initially be some additional costs for training staff in the new design standards and possibly updating their design manuals (note that many local governments simply reference the state manual). For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for infiltration systems more streamlined and efficient. In addition, both the state and local governments will no longer have to review a separate level spreader-filter strip design in concert with the infiltration design, since this requirement has been removed.
2H .1052	**MDC for Bioretention Cells** This rule updates design standards for bioretention cells throughout the entire state. For local governments that are implementing NPDES stormwater programs, there will initially be some additional costs for training staff in the new design standards and possibly updating their design manuals (note that many local governments simply reference the state manual). For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for bioretention cells more streamlined and efficient.
2H .1053	**MDC for Wet Ponds** This rule updates design standards for wet ponds throughout the entire state. For local governments that are implementing NPDES stormwater programs, there will initially be some additional costs for training staff in the new design standards and possibly updating their design manuals (note that many local governments simply reference the state manual). For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for wet ponds more streamlined and efficient. In addition, both the state and local governments will no longer have to review a separate level spreader-filter strip design in concert with the infiltration design, since this requirement has been removed.
2H .1054	**MDC for Stormwater Wetlands** This rule updates design standards for stormwater wetlands throughout the entire state. For local governments that are implementing NPDES stormwater programs, there will initially be some additional costs for training staff in the new design standards and possibly updating their design manuals (note that many local governments simply reference the state manual). For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for stormwater wetlands more streamlined and efficient.

2H .1056	**MDC for Sand Filters** This rule updates design standards for sand filters throughout the entire state. For local governments that are implementing NPDES stormwater programs, there will initially be some additional costs for training staff in the new design standards and possibly updating their design manuals (note that many local governments simply reference the state manual). For the state government, there will initially be costs associated with the rule-making process and updating our technical standards. However, the more clear guidelines in the rules will, over the long-term, make the review and approval process for sand filters more streamlined and efficient. These costs and benefits are not readily quantifiable.

Table 5: Costs and Benefits to the Environment

2H .1019	**Coastal Counties** The proposed rule changes will maintain existing environmental protections at an equivalent level and will likely result in some improvement in water quality. Although the required storm depth that must be treated in SA waters (approximately 15% of the total Coastal County projects) has been reduced by approximately 40%, this does not have a significant impact on the volume of stormwater that is captured and treated on an annual basis. This is because there is a diminishing return associated with making stormwater devices larger. The small loss of water quality treatment volume in SA waters should be more than compensated for the by the slight increase (about 10%) in storm depth that must be captured in the remaining 85% of the Coastal County stormwater permits. The proposed rule removes the requirement for "no discharge" to SA waters, since this is not a realistic alternative in areas where the water table is high and it is not possible to infiltrate stormwater. Instead of the previous method of addressing "no discharge" by putting two SCMs in series, 2H .1019 proposes adding a sand filtration system to any discharging SCMs (such as wet ponds or stormwater wetlands).
2H .1021	**Non-Coastal County HQW and ORW** Addition of vegetated setback requirement could result in reductions of sediment and other pollutant inputs, reduced storm flows and increased base flows to surface waters. Secondary benefits include improved aquatic habitat, reduced destabilization of stream channels by erosive flows, reduced property loss through streambank erosion and reduced future stream restoration needs.
2H .1051	**MDC for Infiltration Systems** The proposed rule removes the current requirement to limit installation of infiltration systems to locations with soil infiltration rates of 0.52 inch per hour or greater. Instead, the development community may customize infiltration system designs to the on-site soil infiltration rates. This change allows the development community to consider infiltration systems throughout the entire state, whereas currently these systems have been limited to Coastal Counties (the only portion of the state with soil infiltration rates at or exceeding 0.52 inches per hour). The other changes such as no longer requiring infiltration systems to be located off-line, removing the limitation on drainage area size, and eliminating the requirement for a level spreader filter strip reduce the costs of building and maintaining infiltration systems without impacting their function or durability. These changes are not anticipated to either benefit or harm the environment other than the possibility that removing barriers to infiltration systems may encourage their use. Choosing an infiltration system over another type of SCM is likely to be beneficial to the environment.
2H .1052	**MDC for Bioretention Cells** The proposed rule increases the effectiveness and durability of bioretention areas while also reducing unnecessary costs. The requirement to provide internal water storage is an inexpensive addition that greatly increases the device's effectiveness at infiltrating stormwater. The more detailed specification for the sand portion of the media is designed to make maintenance easier without incurring much additional construction expense. The same can be said of the requirement to water or walk the media in place rather than compact it mechanically. The previous planting plan requirements often resulted in an overgrown bioretention cell that was needlessly expensive at construction and required resources to maintain and prune.

2H .1053	**MDC for Wet Ponds** The proposed rule will maintain existing environmental protections at a nearly equivalent level while the costs of building and maintaining wet ponds will be reduced by allowing the Hydraulic Retention Time Method in addition to the SA/DA tables, designing the forebay to collect sediment (rather than the entire pond), removing the requirement for a level spreader-filter strip, and removing the requirement for one foot of freeboard.
2H .1054	**MDC for Stormwater Wetlands** The proposed rule will maintain existing environmental protections at a nearly equivalent level while the costs of building and maintaining stormwater wetlands will be reduced by allowing the ponding depth for the design volume to increase from 12 inches to 15 inches, allowing peak attenuation control within the footprint of the wetland and requiring designers to adjust the pH, compaction and other attributes of the first 12 inches of the soil depth for optimal plant growth.
2H .1056	**MDC for Sand Filters** The proposed rule will maintain existing environmental protections at a nearly equivalent level while the costs of building and maintaining sand filters will be reduced by allowing peak attenuation control within the footprint of the sand filter, specifying the sand media more specifically, and simplifying the process for designing sand filters.

Rulemaking Timeline

The anticipated timeline for the rule-making process going forward is as follows:

Nov. 4, 2015	Water Quality Committee approves rule text
Sep. – Dec. 2015	DEMLR develops regulatory impact analysis
Jan. 14, 2016	EMC approves rules & regulatory impact analysis
Jan. 15, 2016	OSBM certifies regulatory impact analysis
Jan. 25, 2016	Last day to file rules with OAH
Feb. 15, 2016	Publication in *NC Register*/Public comment period begins
Mar. 1, 2016	Earliest date for public hearing(s)
Apr. 15, 2016	Public comment period ends
Jul. 14, 2016	EMC adopts rules
Jul. 20, 2016	Deadline to submit rules to RRC
Aug. 18, 2016	RRC approves rules
Sep. 1, 2016	Earliest possible effective date

Chapter 1: NPDES MS4 Stormwater and Urbanizing Areas

Citations & Summaries

15A NCAC 2H .0126 Stormwater Discharges requires that entities subject to NPDES permitting must be issued a permit for stormwater discharges to surface waters in accordance with Rules 2H .0150 and .0153. It also incorporates by reference EPA regulations. *(Proposed for readoption with amendments.)*

15A NCAC 2H .0150 Definitions: NPDES MS4 Stormwater contains definitions that apply to the NPDES MS4 Stormwater program. *(Proposed for readoption with amendments.)*

15A NCAC 2H .0151 NPDES MS4 Stormwater: Designation and Petition Process establishes the process for designating an MS4 owner/operator as a regulated entity. *(Proposed for readoption with amendments.)*

15A NCAC 2H .0152 Development in Urbanizing Areas establishes which development projects are required to apply for a state stormwater permit. *(Proposed for repeal because it is duplicative of 2H .1016 and, as such, is unnecessary)*

15A NCAC 2H .0153 NPDES MS4 Stormwater: Program Implementation establishes the process for a regulated entity to apply for an NPDES permit for stormwater management. *(Proposed for readoption with amendments.)*

15A NCAC 2H .0154 Post-Construction Practices establishes the requirements for the applicability of the stormwater rules as well as the design and maintenance of post-construction stormwater management measures. *(Proposed for repeal because it is duplicative of 2H .1017 and, as such, is unnecessary)*

15A NCAC 2H .1014 Stormwater Management for Urbanizing Areas points to requirements of other rules, but contains no unique rule content. *(Proposed for repeal because it is duplicative of content in Rules 2H .1016 – 1018 and, as such, is unnecessary)*

15A NCAC 2H .1015 Development in Urbanizing Areas contains definitions that apply to the NPDES MS4 Stormwater program. *(Proposed for repeal because it is duplicative of Rule 2H .0150 and, as such, is unnecessary)*

15A NCAC 2H .1016 Development in Urbanizing Areas: Applicability and Delineation establishes which development projects are required to apply for a state stormwater permit based on location in a delineated area. It also contains the requirements the Commission

	must follow to establish new regulated areas. *(Proposed for readoption with amendments.)* **15A NCAC 2H .1017 NPDES and Urbanizing Areas: Post-Construction Stormwater Management** establishes the requirements for the applicability of the stormwater rules as well as the design and maintenance of post-construction stormwater control measures. *(Proposed for readoption with amendments.)* **15A NCAC 2H .1018 Urbanizing Areas: Delegation of Stormwater Management Programs** establishes the process for requesting and approving delegation of the state's Urbanizing Areas program to a local government. *(Proposed for adoption; rule text was relocated from 2H .1016(d).)*
Baseline	The NPDES MS4 Stormwater and Urbanizing Areas rules are currently located in Section .0100 and Section .1000 of 15A NCAC 2H. These rules are administered by the state and local governments and apply to new development projects. The runoff volume match standards are not currently codified but are allowed by policy. The linear transportation projects language is from S.L. 2014-1.
Changes from Baseline	**#1** 2H .1017(2)(j) thru (n) Applicability– Allows newer rules (Jordan Lake, Falls Lake, Coastal Counties, Goose Creek, USMP) to satisfy the post-construction requirements of Rule 2H .1017 when Rule 2H .1017 is administered by the state. This alleviates a burden on the development community because applicants will not be required to apply for a state stormwater permit when their project is subject to one of the listed programs (less stringent). **#2** 2H .1017(4) adds option to allow stormwater control measures designed to achieve runoff volume match instead of runoff treatment criteria (de minimis impact). **#3** 2H .0153(f) added to incorporate the requirement from S.L. 2014-1 allowing NCDOT Best Management Practices (BMPs) for any linear transportation project, including private transportation projects that will be conveyed to the State. This is a codification of current policy for linear transportation projects (de minimis impact). **#4** Requirements for designation of regulated entities in 2H .1016(c) were removed because they are duplicative of Rule 2H .0151 and, as such, it is unnecessary (de minimis impact). **#5** Delegation requirements in 2H .1016(d) and relocate to new rule 2H .1018 for organizational purposes (de minimis impact).
Regulatory Impact	Changes to the NPDES and Urbanizing Areas rules represent a relaxation of the rules and, in some cases, provide additional flexibility to the regulated community. The only substantive changes are to 2H

.1017; however, the changes are a relaxation of the rule and impose a less stringent burden on the regulated community. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments.

Administrative changes are mainly organizational in nature for the purpose of providing clarity to the regulated community thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be negligible and will not represent a significant financial benefit; however, it is noted here for completeness.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 2: Post-Construction Stormwater Management: Purpose and Scope

Citation & Summary	**15A NCAC 2H .1001 Post-Construction Stormwater Management: Purpose and Scope** establishes the purpose of Section 2H .1000 and defines the applicability of the Section to development projects. In addition, it contains items that apply to all the stormwater programs including vested rights, disputes regarding water quality classification, the requirement to obtain a permit, and anti-degradation policy.
Baseline	The current version of 2H .1001 describes the scope and purpose of Section 2H .1000 in just a few sentences.
Changes from Baseline	The proposed update to this rule is much more detailed regarding the applicability of the Section, the parameters for vested rights, disputes regarding water quality classification, and the anti-degradation policy. The proposed content represents content previously located in various other rules in Section 2H .1000 (de minimis impact).
Regulatory Impact	These changes provide clarification of existing rules and statute that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost or benefit to state agencies or local governments. The proposed changes will not require the development community to deviate from current practices; as such, there should be no economic cost or benefit to the development community. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 3: Definitions

Citation & Summary	**15A NCAC 2H .1002 Definitions** contains the definitions for words and phrases used in Section 2H .1000. It also incorporates by reference definitions in Rule 2H .0151 and EPA regulations. Changes to the Definition rule are mainly administrative in nature or provide clarity and do not increase or decrease costs or benefits.
Baseline	Definitions that pertain to Section 2H .1000 are currently contained in both 2H .1002 and 2H .1015 (2H .1015 is proposed for repeal, see Chapter 1). The current definition of "built-upon area" is not included. The current definitions rules currently do not include a number of terms that are important to the implementation of Section 2H .1000 stormwater programs.
Changes from Baseline	**#1** 2H .1002(1) "changes the definition of "built-upon area" to align the rule with recent changes to G.S. 143-214.7. Session Law 2015-149 amended G.S. 143-214.7 such that number 57 stone laid four inches thick over a geotextile fabric as well as certain trails are not considered built-upon area for purposes of implementing stormwater programs (de minimis impact). **#2** Definitions added for terms commonly used in the stormwater permitting process but previously undefined in rule: Design volume; Diffuse flow; Discrete NRCS Curve Number Method; Geotextile fabric; Minimum Design Criteria; Minor modification; Major modification; Peak attenuation volume; Project; Public linear transportation project; Required storm depth; Required treatment volume; Stormwater control measure. These additions provide clarity to the regulated community but do not change requirements (de minimis impact). **#3** Multiple administrative changes such as updating references, renumbering (de minimis impact).
Regulatory Impact	These changes provide clarification of existing rules and statute that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to the terms used in the stormwater permitting program thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as

less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 4: Requirements that Apply to All Subject Projects

Citation & Summary	**15A NCAC 2H .1003 Requirements that Apply to All Subject Projects** contains the requirements that apply to all new development projects that are subject to the state's stormwater rules. The proposed rule has been reorganized for the purpose of clarifying existing requirements that are common to all projects that are subject to stormwater rules under Section 2H .1000. Portions of the proposed 2H .1003 rule have been relocated from other existing rules within Section 2H .1000. Portions of the existing 2H .1003 rule, including items related to applicability and permitting, are proposed to be relocated to other rules in Section 2H .1000. The portion of existing Rule 2H .1003 that remains is currently codified under 2H .1003(d) and pertains to the requirements associated with low density and high density projects. The requirements for low density clarify that diffuse flow is a preferred alternative to collecting and conveying stormwater in a vegetated swale. The current policy for allowing runoff volume match as an alternative approach to runoff treatment is proposed to be codified in this rule.
Baseline	Currently, the general requirements for high and low density projects are repeated in .1005, .1006, .1007 and .1017. Requirements for vegetated conveyances, curb outlet swales, operation and maintenance plans, and flexibility in the designs for stormwater control measures are covered in .1008. The runoff volume match standards are not currently codified.
Changes from Baseline	Multiple organizational changes and rewording in this rule provide clarity to regulated community and the runoff volume match policies are codified in rule (de minimis impact).
Regulatory Impact	Most proposed changes to Rule 2H .1003 are either organizational in nature or are for the purpose of providing clarity to the regulated community thereby making the rule easier to understand. This should translate into less time spent by applicants on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be negligible and will not represent a significant financial benefit; however it is noted here for completeness. None of these changes will require state agencies or local governments to alter their current permitting processes; as such, there should be no economic impact to either state agencies or local governments.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 5: Coastal Counties

Citation & Summary

15A NCAC 2H .1019 Coastal Counties establishes the requirements for the applicability of the Coastal stormwater rule as well as the design and maintenance of post-construction stormwater control measures. Content of this proposed rule was relocated and updated from existing Rule 2H .1005.

Baseline

The Coastal Counties stormwater programs are currently codified in 2H .1005, with ORW saltwater stormwater programs in 2H .1007. Currently, applicants seeking to put a wet pond within shellfishing (SA) waters have to provide a second SCM in series to address the "no discharge" requirement. Within SA waters, the required storm depth is the 1-year, 24-hour storm (over 3.5 inches in most coastal areas). Within non-SA coastal waters, the required storm depth is 1.5 inches.

Changes from Baseline (items in blue analyzed in further detail below)

#1 2H .1019(6)(a) reduces the required storm depth for SA waters from the 1-year, 24-hour storm depth to the 95th percentile storm depth.

#2 2H .1019(7) provides more clear and cost-effective options for treating and discharging stormwater in SA waters compared with the previous "no discharge" requirements. Designers have the option of achieving runoff volume match, treating stormwater with non-discharging SCMs such as infiltration systems, or using discharging SCMs that are equipped with sand filtration capabilities. This option avoids the requirement in current rule 2H .1005 to put SCMs in series in SA waters.

#3 2H .1019(6)(a) also slightly increases the size of the required storm depth for other coastal waters from the 1.5 inch storm to the 90th percentile storm. However, the savings associated with the updates to MDC for stormwater control measures in Rules .1050 through .1062 more than compensate for this slight increase in required storm depth (de minimis impact).

#4 Multiple organizational changes and rewording to provide clarity to regulated community (de minimis impact).

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-241
Owners	0
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	**-241**

To see how these estimates were determined, see information below and Appendix C.

Estimated Regulatory Impact on each SA High Density Project:

		A Development Community			B Owner
		Pre-const	Land	Const	Maint
#0	**Estimated cost per SCM on each SA High Density Project** ($ for all costs except for maint, which is $/year)	37,216	36,539	124,054	2,481
#1	Required design depth decreased from 1-year, 24-hour storm to the 95th percentile storm event.	0	-10%	-10%	0
#2	Sand filtration systems required at the outlet of discharging SCMs rather than another SCM in series.	0	-20%	0	0
	Total of all percentages (added sequentially)	0	-28%	-10%	0
	Est. difference in cost per practice ($)	0	-10,231	-12,405	0
	Est. total difference in cost, 2014 (in $1,000) (10 SA SCMs/year – 0 Local Gov, 10 State Gov)	0	-102	-124	0
	Est. total difference in cost, 2017 (in $1,000)[2]	0	-109	-132	0

Justification for the above numbers:

#o Estimated cost per SCM on each SA High Density Project ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	11.98	acres	*DEQ, BIMS Jan-Dec 2014*
Average built-upon area (BUA) =	6.69	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	25,971	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 30%	$37,216	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$36,539	*Above data + 10% for easements*
Construction Cost	BUA * $18,550	$124,054	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$2,481	*King and Hagan, 2011*

[2] Difference in cost adjusted for inflation by 2.0% but not discounted

#1 Required design depth decreased from 1-year, 24-hour storm to the 95th percentile storm event.

A. Development Community: It is not anticipated that this change will affect either preconstruction costs associated with SA SCMs. However, the required size of SCMs will be reduced because the 95th percentile storm event is approximately 40% less than the 1-year, 24-hour storm event. (0% preconstruction costs, -10% land cost and -10% construction cost).

B. Owner: The owner will have a smaller SCM to maintain; however, because the SCM will be smaller, it may require more frequent clean-outs. It is estimated that these two considerations will balance to a net zero change in maintenance cost (0% maintenance cost).

#2 Sand filtration systems required at the outlet of discharging SCMs rather than another SCM in series.

A. Development Community: The development community will have not have to design a second SCM, but will have to design a sand filtration system as part of the stand-alone SCM. It is estimated that these two considerations will balance to a net zero change in maintenance cost (0% pre-construction cost). This change will reduce the footprint of the stormwater treatment system by eliminating the second SCM (-20% land cost). The cost of constructing a sand filtration system is estimated to be less than the cost of constructing a second SCM (-10% construction cost)

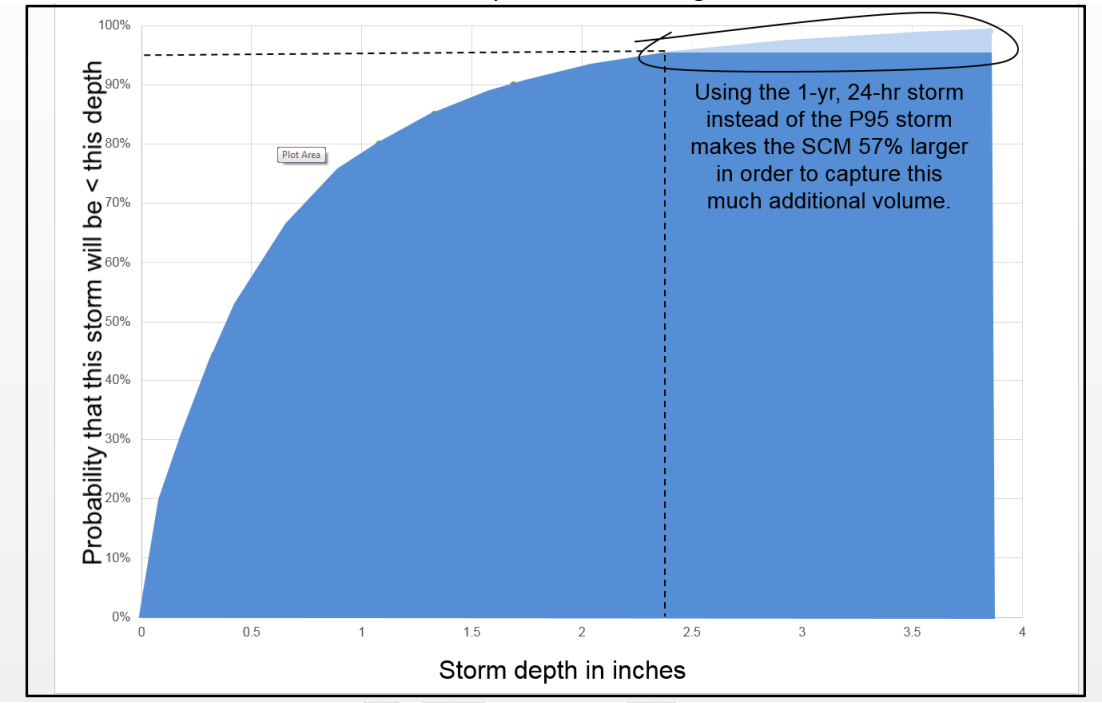
B. Owner: The owner will have only one SCM to maintain; however, there will be a sand filtration system that does require maintenance. It is estimated that these two considerations will balance to a net zero change in maintenance cost (0% maintenance cost).

Costs and Benefits to the Environment of 2H .1019 Coastal Counties:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions as contained in Rules 15A NCAC 02H .1005, the proposed rule changes will maintain existing environmental protections at an equivalent level and will likely result in some improvement in water quality.

Although 2H .1019(6)(a) reduces the required storm depth that must be treated in SA waters (approximately 15% of the total Coastal County projects) by approximately 40%, this does not have a significant impact on the volume of stormwater that is captured and treated on an annual basis. This is because there is a diminishing return associated with making stormwater devices larger (see Figure 1).

Figure 1:
Storm Probability Curve for Wilmington, NC



The small loss of water quality treatment volume in SA waters should be more than compensated for the by the slight increase (about 10%) in storm depth that must be captured in the remaining 85% of the Coastal County stormwater permits.

The proposed rule removes the requirement for “no discharge” to SA waters, since this is not a realistic alternative in areas where the water table is high and it is not possible to infiltrate stormwater. Instead of the previous method of addressing “no discharge” by putting two SCMs in series, 2H .1019 proposes adding a sand filtration system to any discharging SCMs (such as wet ponds or stormwater wetlands). Sand filtration systems have been shown to be highly effective in removing fecal coliform, a major pollutant of concern in SA waters (Nassar and Hajjaj, 2013).

The proposed changes provide clarity as to design standards for all projects subject to Coastal County stormwater requirements, thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Chapter 6: Universal Stormwater Management Program

Citation & Summary	**15A NCAC 2H .1020 Universal Stormwater Management Program** (USMP) establishes the requirements for an optional program that local governments can choose to administer in place of other mandatory stormwater programs such as Water Supply Watershed, High Quality Waters, and Coastal Rules. The USMP is administered by local governments and it applies to new development projects.
Baseline	Five communities in North Carolina are currently implementing a USMP. The runoff volume match standards are not currently codified but are allowed by policy.
Changes from Baseline	**#1** 2H .1020(f) adds option to allow stormwater control measures designed to achieve runoff volume match instead of runoff treatment criteria. This is a codification of current policy (de minimis impact).
Regulatory Impact	None of these changes will require local governments to alter their current permitting processes; as such, there should be no economic cost or benefit to local governments. The proposed changes will not require the development community to deviate from current practices; as such, there should be no economic cost or benefit to the development community. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 7: Non-Coastal County HQW and ORW

Citation & Summary

15A NCAC 2H .1021 Non-Coastal County High Quality Waters (HQW) and Outstanding Resource Waters (ORW) establishes the requirements for the applicability of the HQW and ORW stormwater rules as well as the specific requirements for control and treatment of stormwater.

Baseline

Non-Coastal County High Quality Waters (HQW) and Outstanding Resource Waters (ORW) rules are currently located in 15A NCAC 2H .1006 and .1007, respectively. These rules are administered by the state and apply to new development projects located in areas that drain to HQW and ORW classified waterbodies. The HQW and ORW stormwater requirements are combined into one rule for efficiency.

Changes from Baseline (item in blue analyzed in further detail below)

#1 2H .1021(7) adds a requirement for 30-foot vegetated setback for high density development. Currently, no vegetated setback is required for high density development in HQW and ORW areas. This requirement is added for consistency with other stormwater rules, all of which require setbacks on high density development (more stringent, but minimal economic impact).

#2 2H .1021(5) adds option to allow for a single-family residential projects to qualify as low density if meets average lot size criteria over the entire project rather than minimum lot size for each lot (less stringent)

#3 2H .1021(6) adds option to allow stormwater control measures designed to achieve runoff volume match instead of runoff treatment criteria. This is a codification of current policy (de minimis impact).

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-114.8
Owners	0
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	-114.8

See below for information on how these estimates were determined.

Estimated Costs and Benefits

	A Development Community			B Owner
	Pre-const	Land	Const	Maint
#1 2H .1021(7) adds a requirement for 30-foot vegetated setback for high density development.	0	+4,249	0	0
#2 2H .1021(5) adds option to allow for a single-family residential projects to qualify as low density if meets average lot size criteria over the entire project rather than minimum lot size for each lot.	0	-36,890	-75,600	0
Estimated total difference in cost, 2014 (in $1,000)	0	-32.6	-75.6	0
Estimated total difference in cost, 2017 (in $1,000) [3]	0	-34.6	-80.2	0

#1 2H .1021(7) adds a requirement for 30-foot vegetated setback for high density development. Currently, no vegetated setback is required for high density development in HQW and ORW areas. This requirement is added for consistency with other stormwater rules, all of which require setbacks on high density development.

A. Development Community

As measured from the baseline conditions as contained in existing Rules 15A NCAC 02H .1006 and .1007, this proposed change will result in the restriction of new development in a 30-foot wide vegetated setback along surface waters. A vegetated setback is an area of natural or established vegetation directly adjacent to surface waters through which stormwater runoff flows in a diffuse manner to protect surface waters from degradation due to development activities. This change could result in opportunity cost to the development community from lost opportunity to build in the vegetated setback. The cost to the development community is expected to be limited, however, because of the relatively small amount of land area that is potentially subject to this Rule. The total area that is potentially subject to Rule 2H .1021 makes up only 8.2% of the total land area of the state. Of that area, 44% is already subject to an existing state setback or buffer requirement (Phase 2, Water Supply Watershed, riparian buffer rules), so that area would not be impacted by the proposed rule change. This means that only the remaining 4.7% of the land area of the state would be potentially impacted by this proposed rule change (Figure 2 and Table 6).

In addition, permitting data support the assertion that very few development projects are subject to this Rule, and of those that are subject, even fewer will be affected by a change to a setback requirement because of the absence of surface waters in project areas. Only properties that contain or are within 30 feet of a surface water will be affected by this proposed rule change. Of the seven permits that were issued to high density projects in non-coastal HQW and ORW management areas between 2011 and 2015, none of them had a surface water within their project area. DEMLR has no data to suggest that there will be an increase in the number of permits being issued in these areas within the foreseeable future.

[3] Difference in cost adjusted for inflation by 2% but not discounted

Figure 2:
HWQ and ORWs not subject to another vegetated setback/buffer requirement

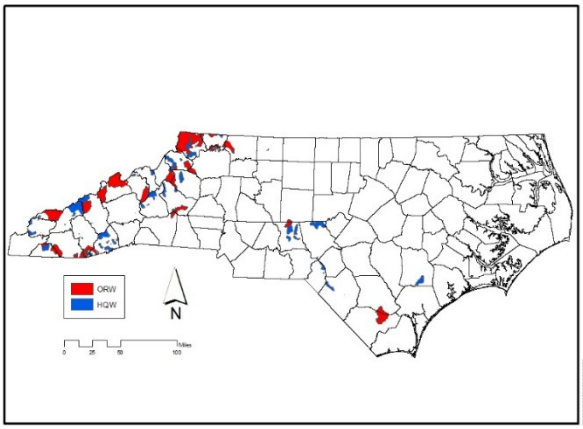


Table 6:
Area potentially subject to HWQ and ORWs stormwater requirement

	Area in acres	Percent of state
Total land area of the State	34,444,160	100%
Area potentially subject to Rule 2H .1021	2,834,339	8.2%
Area not subject to another vegetated setback/buffer	1,615,344	4.7%

Further limiting the economic impact to the development community, this proposed change will potentially impact only those projects which are high density. Between 2011 and 2015, a total of nine permits were issued to new development projects in non-coastal HQW and ORW management areas. Of those ten permits, seven were high density project. This represents a small fraction -- about 1.6 percent -- of the total number of state stormwater permits issued to high density projects statewide during the same time period (Table 7). The average drainage area for the high density projects in HQW and ORW areas was only 1.7 acres compared to 40.4 acres for all state stormwater permits. Projects with smaller drainage areas have less land area within their projects. As such, these projects have less total area that could be potentially impacted by this proposed change to the vegetated setback requirement.

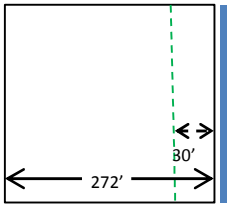
Table 7:
Permit Data for the Five-Year Period 2011-2015

	No. of Permits Issued for New Projects		**Average Drainage Area**	
	Low Density	**High Density**	**Low Density**	**High Density**
Non-coastal HQW & ORW	2	7	223.7 acres	1.7 acres
All state stormwater permits	377	430	37.5 acres	40.4 acres

If we assume that 1.4 projects are permitted per year [7 high density projects/5 years], and all those projects had a surface water within their projects area, the estimated annual opportunity cost to the development community would be a total of $4,249. This was based on the following assumptions and calculations:

Assumptions

- Project area is a square
- Surface water runs along entire length of project area
- Average project size is 1.7 acres (272' x 272').
- Average value of land per acre in NC is $16,230[4] (Larson, 2015).



Project area within 30' vegetated setback = 30'x272' (0.187 acres)
Opportunity cost = [0.187 acres vegetated setback] x [$16,230 avg land value/acre] x [1.4 projects per year]

The above cost estimate is conservative since it likely that economic impacts will be further limited by overlapping local government ordinances. Local governments often have their own setback requirements in place to protect natural resources, property and infrastructure. This includes floodplain management, land conservation, and zoning ordinances. These local setback requirements often equal or exceed the proposed 30-foot vegetated setback.

In summary, there are numerous circumstances that would need to align to realize an opportunity cost to the development community from the proposed rule change, and the likelihood of such a scenario is very small given the reasons stated above. In addition, developers may have the ability to sell their developments or parcels within them at higher prices using conserved vegetated setback areas as value-added amenities and thus recoup the opportunity costs of the foregone land use. Studies have shown that housing prices are significantly higher for parcels located next to a vegetated buffer[5]. For these reasons, the annual cost to the development community associated with this proposed rule change will likely be less than the conservative estimate of $4,249.

B. Owner

There may be a minor additional cost associated with maintaining the vegetated setback; however, it is assumed that this cost will be more than outweighed by the avoidance of potential flood damage to structures located within close proximity to a waterbody (0% impact).

[4] `For purposes of this analysis, the value of land in NC is estimated to be $16,230 per acre. This figure is from Larson 2015, US Dept of Commerce, *New Estimates of Value of Land of the United States.*

[5] `Schueler, T.R., 1995. Site Planning for Urban Stream Protection. Center for Watershed Protection. Metropolitan Washington Council of Governments.

#2 2H .1021(5) adds option to allow for a single-family residential projects to qualify as low density if meets average lot size criteria over the entire project rather than minimum lot size for each lot.

A. Development Community

This proposed change will not require the development community to deviate from current stormwater or permitting practices; as such, there will be neither a direct cost nor opportunity cost associated with new development, existing development, or redevelopment activities as a result of the proposed rule changes.

This proposed change may be a benefit to members of the development community in that it could allow non-buildable areas to be counted as open space in exchange for smaller lot sizes. In these cases, it would allow an increased number of housing units to be built and sold on a given project while remaining under a density threshold. Projects that remain under the low density threshold are exempt from stormwater treatment requirements. This could lead to an average cost saving per site of about $54,000[6] for in capital cost of installing stormwater control measures, plus savings related to annual operation and maintenance costs. In addition, developers typically charge more for lots in dense, walkable subdivisions -- between $13,000 and $18,000 per acre, depending on location[3]. If we assume that 1.4 projects are permitted per year [7 high density projects/5 years], and all those projects could remain under the low density threshold because of this rule change, the estimated annual economic benefit to the development community would be a total of $112,490 [-$75,600 (construction cost); -$36,890 land cost)]. This was based on the following:

Annual SCM construction cost savings = [$54,000 avg cost savings per SCM] x [1 SCM per project] x [1.4 projects per year]

Increased land value (i.e., decreased land cost) = [1.4 projects per year] x [1.7 avg acres per project] x [$15,500 avg premium per acre]

B. Owner

Open space in a residential setting can be used for shared purposes such as recreational activities or other amenities which can make development communities attractive to potential buyers. Studies have shown that increasing the percentage of open space land surrounding a property can increase average house prices by up to one percent of the total property value[7]. Based on a median home value of $148,200[8], an increase of one percent would be $1,482. We do not have data on the average number of lots in a 1.7 acre development, so the average economic benefit of this rule change on owners cannot be monetized, but it is expected to be relatively minimal (0% impact).

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[6] See more details on the costs of various stormwater control measures on page 58 of the fiscal note the DENR Division of Water Quality prepared for the Falls Lake Nutrient Management Strategy rulemaking in 2010 available at the following link. http://www.osbm.state.nc.us/files/pdf_files/DENR06082010_v2.pdf

[7] See more details on the benefits of open space in Active Living Research report, May 2010, http://www.americantrails.org/resources/economics/Economic-Benefits-Trails-Open-Space-Walkable-Community.html

[8] See more details on median home values in NC: http://www.zillow.com/nc/home-values/

Costs and Benefits to the Environment of 2H .1021 Non-Coastal HWQ and ORW:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions as contained in Rules 15A NCAC 02H .1006 and .1007, the proposed rule changes will maintain existing environmental protections at a nearly equivalent level.

The proposed change to the building density represents a slight relaxation of the current rule in that it will allow single-family residential projects to qualify as low density based on average lot size (one dwelling unit per acre) rather than minimum lot size (all lots one acre or greater). This may result in the construction of additional housing units located on smaller lots which are likely clustered on the project site. Depending on where the housing units are clustered relative to receiving waters, there could be additional stormwater runoff to the receiving waters from the developed area which could result in degraded water quality. The likelihood of such a scenario is very small given that stormwater runoff from the developed area will reach the receiving waters after being conveyed through vegetated areas. Those vegetated areas provide some pollutant removal and stormwater infiltration functions. On the other hand, clustering development in this way will require that areas of open space be maintained. When located downstream from the developed portions of a project, open space can provide additional opportunities for stormwater pollutant removal and infiltration. This can help protect surface waters from water quality impacts. For these reasons, the cost to the environment associated with this proposed change should be inconsequential.

The proposed change to the vegetated setback requirement for high density projects will have a potential benefit to the environment. A vegetated setback along surface waters provides numerous water *quality* and water *quantity* benefits to the surface water. Water *quality* benefits would include reductions of sediment and other pollutant inputs. Water *quantity* benefits include reduced storm flows and increased base flows to surface waters. Secondary benefits resulting from actions taken to protect water quality and control water quantity include improved aquatic habitat, reduced destabilization of stream channels by erosive flows, reduced property loss through streambank erosion and reduced future stream restoration needs. While these environmental benefits could be significant, we found that they are not readily quantifiable; as such, they could not be monetized.

Chapter 8: New Stormwater Technologies Program

Citation & Summary	**15A NCAC 2H .1031 New Stormwater Technologies (NEST) Program** establishes the requirements for application, approval and monitoring of new stormwater technologies. This rule is administered by the state and applies to new stormwater technologies that are submitted to DEQ for review and approval to allow their use in lieu of traditional stormwater control measures.
Baseline	The current language in 2H .1008(g) regarding innovative systems is broad and somewhat vague, allowing innovative systems to be approved on a "demonstration basis" with a "reasonable expectation that the control measures will be successful." This language requires staff to adopt a pathway through policy. This policy has been implemented for more than ten years and has yielded only one approved innovative system.
Changes from Baseline	The proposed rule will codify policies that DEQ has implemented while maintaining our current level of environmental protection. These changes will provide clarity to the regulated community by outlining the steps for submittal of a new technology into the review program as well as the long-term monitoring and reporting requirements that have been required by policy (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to the process for approval of an innovative stormwater technology thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 9: Permit Administration, Standard Permitting Process, General Permits, Transfers/Renewals

Citations & Summaries	**15A NCAC 2H .1040 Permit Administration** establishes the requirements that entities subject to a state stormwater program must follow to apply for a permit. It also contains requirements that the state must follow in regards to permit processing times, delegation, permit denial, revocation, and public notice. Content of this proposed rule was relocated and updated from existing Rules 2H .1003; .1008; .1010; .1011; and .1012. **15A NCAC 2H .1041 General Permits** establishes the process for the development and administration of general permits. General permits are developed to regulate categories of activities that involve the same or similar operations. Content of this proposed rule was relocated from existing Rules 2H .1013. Minimal changes were made to the existing rule content. **15A NCAC 2H .1042 Standard Permitting Process** establishes the requirements for the application, review, issuance and denial of a state stormwater permit under the standard permitting process. Content of this proposed rule was relocated and updated from existing Rules 2H .1003; .1008; .1009; and .1010. **15A NCAC 2H .1045 Requirements for Permit Transfers and Renewals** codifies the requirements for the transfer and renewal of state stormwater permits, which are currently handled through policy rather than rule.
Baseline	DEQ administers processes for issuing permits as well as permit modifications, transfers and renewals. Those requirements are currently codified in portions of existing Rules 2H .1003; .1008; .1009; .1010; .1011; and .1012. Most of the processes for permit transfers and renewals are currently administered by policy rather than rule language. The permit transfer and renewal requirements are made available to applicants on application forms provided during the permit application process.
Changes from Baseline	**#1** 2H .1045(3)(f) allows a licensed professional to certify that the stormwater management system has been inspected, and that it was found to be built and maintained in accordance with the approved plans (less stringent).
Regulatory Impact	Currently, DEQ conducts its own inspections which can lengthen the timeframe for completing a permit transfer depending on agency staff

availability and challenges associated with scheduling the inspection with the owner. This proposed rule change will streamline the permit transfer process by not requiring an additional inspection by agency staff, possibly shortening the timeframe for completing a permit transfer. This should result in a savings for the agency in terms of staff time spent scheduling and conducting the inspection, as well as savings in terms of cost of travel to project sites. This rule change could also result in a modest savings to the regulated community in terms of time spent scheduling and participating in the agency inspection. Assuming that the inspection performed by a licensed professional is equivalent in quality to an inspection by agency staff, environmental protections will remain at an equivalent level. None of these changes will require local governments to alter their current permitting processes; as such, there should be no economic impact to local governments. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Chapter 10: Fast Track Permitting Process

Citations & Summaries	**15A NCAC 2H .1043 Fast Track Permitting Process: Authorization to Construct** establishes the first step of the fast-track permitting process, which is the issuance of an authorization to construct. This is issued by DEQ staff after a completeness review of the application package. The technical review is delayed until after the project is completed and the as-builts are submitted. **15A NCAC 2H .1044 Fast Track Permitting Process: Final Permit** establishes the second step of the fast-track permitting process, which is the issuance of the final permit. The applicant will submit the as-built engineering plans for DEQ's technical review. If the as-built plans do not comply with the MDC, then the applicant will have the opportunity to address the lack of compliance prior to initiation of compliance activities.
Baseline	Currently, DEQ has a fast-track stormwater permitting process for low density projects only. It is not used very frequently (fewer than three projects a year are using it).
Changes from Baseline	These two rules create a fast-track stormwater permitting process for both high and low density projects. Permittees seeking a fast-track permit would have a two-step process: the authorization to construct, and the final permit. Each step would have a permit fee associated with it. However, since this is a voluntary option for obtaining a permit, the development community can decide whether there is an economic advantage to obtaining the authorization to construct quickly even though this necessitates obtaining a second permit and paying a second permit application fee (de minimis).
Regulatory Impact	None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost or benefit to state agencies or local governments. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 11: MDC for All Stormwater Control Measures

Citation & Summary	**15A NCAC 2H .1050 MDC for All Stormwater Control Measures** establishes the design, construction and maintenance requirements that apply to all stormwater control measures (SCMs). The proposed updates to the MDC provide greater flexibility and overall reduce the size and costs of SCMs. Therefore, this rule is considered less stringent.
Baseline	Currently, the Minimum Design Criteria (MDC) that apply to all SCMs are contained in both the 2H .1008 rule as well as in the Stormwater BMP Manual. The MDC Team discussed MDC for all SCMs at length.
Changes from Baseline	**#1** A number of requirements that were previously in the BMP Manual, such as having a bypass device for larger flow events and protecting inlet and outlet structures against erosion, are proposed to be codified in 2H .1050 (de minimis). **#2** SCMs shall not include an outlet structure that is set more than 6" below the seasonal high water table (SHWT) unless it can be demonstrated that the device will not dewater waters of the state and that the treatment volume of the SCM will not be compromised by groundwater inflow. This is a codification of policy (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes provide clarity as to technical standards required for SCMs thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 12: MDC for Infiltration Systems

Citation & Summary

15A NCAC 2H .1051 MDC for Infiltration Systems sets forth the minimum design criteria (MDC) for infiltration systems, including infiltration basins, trenches, and underground systems. The proposed updates to the current design of infiltration systems provide greater flexibility and typically reduce the required size and cost of this SCM. Therefore, this rule is considered less stringent.

Baseline

The current design standards for infiltration systems are covered in two places: 2H .1008 and the Infiltration Device Chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed infiltration system MDC at length.

Changes from Baseline (items in blue analyzed in further detail below)

#1 There is now a more customized design whereby Infiltration systems shall be designed to completely dewater the treatment volume to the bottom of the infiltration device within 72 hours. A site-specific soil investigation shall be performed to establish the hydraulic properties and characteristics of the area in which the infiltration device will be sited. Soil infiltration rates are no longer limited to 0.52 inch/hour or greater.

#2 It is no longer required that infiltration systems be located off-line.

#3 Peak attenuation volume may be contained within the footprint of an infiltration system.

#4 There is no longer a limit on the size of the drainage area that may be treated in an infiltration system.

#5 There is a new allowance to remove In-situ soils and replace them with infiltration media or infiltration media may be placed on top of in-situ soils if the applicant can demonstrate that the modified soil profile allows for drainage of the treatment volume within 72 hours.

#6 There is a new requirement for infiltration devices located under the ground surface to be equipped with a minimum of one inspection port shall be provided.

#7 A level spreader-filter strip is no longer required at the outlet of infiltration systems.

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-947
Owners	-7.5
Local Governments	0
State Government	-4.7
NC Department of Transportation	0
TOTALS	-959

For more information on how these estimates were determined, see information below and Appendix C.

Regulatory Impact of 2H.1051 MDC for Infiltration Systems:

		Development Community			Owner
		Pre-Const	Land	Const	Maint
#0	**Estimated current cost per Infiltration System** ($/system except for maintenance, which is $/year)	19,244	9,117	48,111	481
#1	Customized design to completely dewater the treatment volume to the bottom of the infiltration device within 72 hours.	+5%	-5%	-10%	0
#2	It is no longer required that infiltration systems be located off-line.	-5%	-5%	-5%	-10%
#3	Peak attenuation volume may be contained within the footprint of an infiltration system.	0	-5%	-10%	-10%
#4	There is no longer a limit on the size of the drainage area that may be treated in an infiltration system.	-5%	-5%	-5%	0
#5	There is a new allowance to remove In-situ soils and replace them with infiltration media or infiltration media may be placed on top of in-situ soils if the applicant can demonstrate that the modified soil profile allows for drainage of the treatment volume within 72 hours.	0	-5%	+5%	0
#6	There is a new requirement for infiltration devices located under the ground surface to be equipped with a minimum of one inspection port shall be provided.	0	0	+5%	-5%
#7	A level spreader-filter strip is no longer required at the outlet of infiltration systems.	-10%	-10%	-10%	-10%
	Total of all percentages (added sequentially)	-15%	-30%	-27%	-31%
	Est. difference in cost per practice ($)	-2,887	-2,735	-12,990	-149
	Est. total difference in cost, 2014 (in $1,000) (48 infiltration systems/year – 0 Local Gov, 48 State Gov)	-138	-131.3	-623.5	-7.1
	Est. total difference in cost, 2017 (in $1,000)[9]	-146.4	-139.3	-661.7	-7.5

[9] Difference in cost adjusted for inflation by 2% but not discounted

Justification for the above percentages:

#o Estimated cost per Infiltration System ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	1.90	acres	*DEQ, BIMS Jan-Dec 2014*
Average BUA =	1.15	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA) =	6,480	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 40%	$19,244	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$9,117	*Above data + 10% for easements*
Construction Cost	BUA * $41,750	$48,111	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 1%	$481	*King and Hagan, 2011*

#1 Customized design to completely dewater the treatment volume to the bottom of the infiltration device within 72 hours.

A. Development Community: It requires more designer time to create a custom-fit between the size of the infiltration system and the infiltration rate of the in-situ soils (+5% designer time). However, the development community will likely be able to reduce the footprint of infiltration systems because they will be able to account for infiltration during the storm event rather than sizing the system to hold the entire design storm (-5% land cost). This will result in a corresponding decrease in construction costs (-10% construction cost).

B. Owner: It is not anticipated that this change will affect the cost of maintaining infiltration systems (0% maintenance cost).

#2 It is no longer required that infiltration systems be located off-line.

A. Development Community: The designer no longer needs to design a separate flow splitting device, but can have a simpler flow bypass system within the footprint of the infiltration system (-%5 designer time). This will reduce the footprint of the overall infiltration system somewhat (-5% land cost) and will also reduce the construction cost associated with building a separate flow splitting device (-5% construction cost).

B. Owner: The owner will not have the burden of maintaining a separate flow splitting device in addition to maintaining the infiltration system (-10% maintenance cost).

#3 Peak attenuation volume may be contained within the footprint of an infiltration system.

A. Development Community: This change does not affect the designer time associated with controlling peak flows; however, there are likely to be significant savings in the amount of space and the construction costs of the overall stormwater system because the development community will not need a separate device to control peak flows (0% pre-construction cost, -5% land cost and -10% construction costs).

B. Owner: The owner will not have the responsibility of maintaining a separate device to control peak flows (-10% maintenance cost).

#4 There is no longer a limit on the size of the drainage area that may be treated in an infiltration system.

A. Development Community: This change may reduce designer time, land cost and construction cost by allowing the development community to centralize stormwater treatment into a single larger infiltration practice (-5% each for designer time, land cost and construction cost).

B. Owner: It is not anticipated that this change will affect the maintenance cost associated with infiltration devices (0% maintenance cost).

#5 There is a new allowance to remove In-situ soils and replace them with infiltration media or infiltration media may be placed on top of in-situ soils if the applicant can demonstrate that the modified soil profile allows for drainage of the treatment volume within 72 hours.

A. Development Community: It is not anticipated that this change will affect increase designer time (0% designer time). This allowance may decrease land costs by allowing space-efficient infiltration systems on sites that might not have otherwise had adequate separation from the SHWT to allow infiltration systems (-5% land cost). Placement of the infiltration media may cause a slight increase in construction costs (+5% construction cost).

B. Owner: It is not anticipated that this change will affect the maintenance cost associated with infiltration devices (0% maintenance cost).

#6 There is a new requirement for infiltration devices located under the ground surface to be equipped with a minimum of one inspection port shall be provided.

A. Development Community: It is not anticipated that this change will affect either design time or land costs associated with infiltration systems (0% designer time and 0% land cost). There will be a slight increase in construction costs associated with this change (+5% construction cost).

B. Owner: The provision of an inspection port will significantly simplify the maintenance of infiltration devices by allowing the owner to quickly observe if infiltration is occurring at the required rate (-5% maintenance cost).

#7 A level spreader-filter strip is no longer required at the outlet of infiltration systems.

A. Development Community: This change will reduce design cost by eliminating the need to size, draw and specify the level spreader-filter strip (-10% designer time). There will be a significant savings in the land consumed by the infiltration system (-10% land cost). Removal of the level spreader-filter strip requirement will also reduce construction costs somewhat (-10% construction cost).

B. Owner: The owner will no longer have the expense of maintaining the level spreader-filter strip (-10% maintenance cost).

Costs and Benefits to the Environment of 2H .1051 MDC for Infiltration Systems:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions, the proposed rule changes will maintain and possibly existing improve environmental protection when an infiltration system is selected as the SCM for a given site.

The proposed changes remove the current requirement in 2H .1008 to limit installation of infiltration systems to locations with soil infiltration rates of 0.52 inch per hour or greater. Instead, the development community may customize infiltration system designs to the on-site soil infiltration rates. This change allows the development community to consider infiltration systems throughout the entire state, whereas currently these systems have been limited to Coastal Counties (the only portion of the state with soil infiltration rates at or exceeding 0.52 inches per hour). When rain falls in natural, undeveloped areas, the water is absorbed and filtered by soil and plants (US EPA, 2015). Infiltration is one of the most effective practices for protecting surface waters because it removes nearly all of the pollutants from stormwater while also helping to protect natural stream hydrology and structure. Often, streams in urban areas experience significant erosion due to the hydrologic changes associated with development activities.

The other changes from the baseline such as no longer requiring infiltration systems to be located off-line, removing the limitation on drainage area size, and eliminating the requirement for a level spreader filter strip were judged by the MDC Team to reduce the costs of building and maintaining infiltration systems without impacting their function or durability. These changes are not anticipated to either benefit or harm the environment other than the possibility that removing barriers to infiltration systems may encourage their use. Choosing an infiltration system over another type of SCM is likely to be beneficial to the environment.

The requirement to include an inspection port on infiltration systems will assist owners in determining if infiltration systems are functioning as designed; this is intended to improve the environmental benefit of infiltration systems.

While the environmental benefits associated with 2H .1051 MDC for Infiltration Systems could be significant, we found that they are not readily quantifiable; as such, they could not be monetized.

Chapter 13: MDC for Bioretention Cells

Citation & Summary

15A NCAC 2H .1052 MDC for Bioretention Cells sets forth the minimum design criteria (MDC) for bioretention cells, including both tree/shrub and grassed cells. The proposed updates to the current design of bioretention cells provide greater flexibility and typically reduce the size and cost of this SCM. Therefore, this rule is considered less stringent.

Baseline

The current design standards for bioretention cells are covered in Bioretention Chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed bioretention cell MDC at length.

Changes from Baseline (items in blue analyzed in further detail below)

#1 Bioretention cells are now allowed to store peak attenuation volume at a depth of up to 24 inches above the planting surface. .

#2 The media shall be a homogeneous soil mix of with approximate volumes of: 75 to 85 percent medium to coarse washed sand (ASTM C33)) 10 percent fines (silt and clay), and 5 to 15 percent organic matter (such as pine bark fines). If total nitrogen is the target pollutant, it is recommended to use 10-15% fines.

#3 The specifications for media P-index have been relaxed in non-NSW waters, where the P-index can now go up to 50.

#4 There is a new requirement that the media shall not be mechanically compacted.

#5 There is a new requirement that the bioretention cell shall be maintained in a manner that results in a drawdown of at least one inch/hour at the surface.

#6 Planting plan requirements have been made more flexible and state that the planting plan shall be designed to achieve 50% coverage with either canopy, ground cover, or a combination of canopy and ground cover at five years after planting. If sod is used, then it shall non-clumping and deep-rooted.

#7 There is a new requirement to provide an underdrain with internal water storage sunless it can be demonstrated that the in-situ soil infiltration rate is two inches per hour or greater immediately prior to the initial placement of the media. The internal water storage zone shall extend to a minimum of 18" below the planting surface.

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-1,854
Owners	-145
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	**-2,000**

For more information on how the above estimates were determined, see below and Appendix C.

Regulatory Impact of 2H.1052 MDC for Bioretention Cells:

		Development Community			Owner
		Pre-const	Land	Const	Maint
#0	**Estimated cost per bioretention cell** ($ for all costs except for maintenance, which is $/year)	24,563	11,222	98,250	1,965
#1	Bioretention cells are now allowed to store peak attenuation volume at a depth of up to 24 inches above the planting surface. The peak attenuation outlet shall be a maximum of 18 inches above the planting surface.	0	-10%	-10%	-10%
#2	The media shall be a homogeneous soil mix of with approximate volumes of: 75 to 85 percent medium to coarse washed sand (ASTM C33) 10 percent fines (silt and clay), and 5 to 15 percent organic matter (such as pine bark fines). If total nitrogen is the target pollutant, it is recommended to use 10-15% fines.	0	0	+5%	-10%
#3	The specifications for media P-index have been relaxed in non-NSW waters, where the P-index can now go up to 50.	0	0	0	0
#4	There is a new requirement that the media shall not be mechanically compacted. It is recommended to either water it or walk on it as it is placed.	0	0	+5%	-10%
#5	There is a new requirement that the bioretention cell shall be maintained in a manner that results in a drawdown of at least one inch per hour at the planting surface.	0	0	0	+5%
#6	Planting plan requirements have been made more flexible and now state that the planting plan shall be designed to achieve 50% coverage with either canopy, ground cover, or a combination of canopy and ground cover at five years after planting. Sod shall be a non-clumping, deep-rooted species.	-5%	0	-10%	-10%
#7	There is a new requirement to provide an underdrain with internal water storage sunless it can be demonstrated that the in-situ soil infiltration rate is two inches per hour or greater immediately prior to the initial placement of the media. The internal water storage zone shall extend to a minimum of 18" below the planting surface.	+5%	0	+5%	+5%
	Total of all percentages (added sequentially)	0	-10%	-6%	-28%
	Est. difference in cost per practice ($)	0	-1,122	-5,895	-550
	Est. total difference in cost, 2014 (in $1,000) (249 bioretention/year – 249 Local Gov, 0 State Gov)	0	-279.4	-1,468	-137
	Est. total difference in cost, 2017 (in $1,000) [10]	0	-296.5	-1,558	-145

[10] Difference in cost adjusted for inflation by 2% but not discounted

Justification for the above data:

#o Estimated cost per bioretention cell ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	3.76	acres	*Town of Cary, Jan 2014 -Dec 2015*
Average built-upon area (BUA) =	2.62	acres	*Town of Cary, Jan 2014 -Dec 2015*
Average surface area (SA)	7,976	square feet	*Town of Cary, Jan 2014 -Dec 2015*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 25%	$24,563	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$11,222	*Above data + 10% for easements*
Construction Cost	BUA * $37,500	$98,250	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$1,965	*King and Hagan, 2011*

#1 Bioretention cells are now allowed to store peak attenuation volume at a depth of up to 24 inches above the planting surface. The peak attenuation outlet shall be a maximum of 18 inches above the planting surface.

A. **Development Community:** This change does not affect the designer time associated with controlling peak flows; however, there are likely to be savings in the footprint and the construction costs of the stormwater system because the development will not need a separate device to control peak flows (0% pre-construction cost, -10% land cost and -10% construction cost).

B. **Owner:** The owner will not have the responsibility of maintaining a separate device to control peak flows (-10% maintenance cost).

#2 The media shall be a homogeneous soil mix of with approximate volumes of: 75 to 85 percent medium to coarse washed sand (ASTM C33) 10 percent fines (silt and clay), and 5 to 15 percent organic matter (such as pine bark fines). If total nitrogen is the target pollutant, it is recommended to use 10 to 15 percent fines in the media mix. There is no longer a requirement for a specific infiltration rate.

A. **Development Community:** This change does not affect the level of designer effort or the amount of space that the bioretention cell takes up. However, there will be a slight increase in construction costs associated with checking the media to ensure that it meets the specification upon delivery (0% pre-construction cost, 0% land cost and +5% construction cost).

B. **Owner:** This change is expected to reduce maintenance costs for the owner by addressing media clogging, which is the most frequent maintenance issue associated with bioretention cells (-10% maintenance cost).

#3 The specifications for media P-index have been relaxed in non-NSW waters, where the P-index can now go up to 50.

A. **Development Community:** It is not anticipated that this change will affect the cost to the development community associated with bioretention cells (0% pre-construction cost, 0% land cost and 0% construction cost).

B. **Owner:** It is not anticipated that this change will affect the maintenance efforts associated with bioretention cells (0% maintenance cost).

#4 There is a new requirement that the media shall not be mechanically compacted. It is recommended to either water it or walk on it as it is placed.

A. **Development Community:** This change does not affect the level of designer effort or the amount of space that the bioretention cell takes up. However, there will be a slight increase in construction costs associated with using non-mechanical means to tamp down the media (0% pre-construction cost, 0% land cost and +5% construction costs).

B. **Owner:** This change is expected to reduce maintenance costs for the owner by addressing media clogging, which is the most frequent maintenance issue associated with bioretention cells (-10% maintenance cost).

#5 There is a new requirement that the bioretention cell shall be maintained in a manner that results in a drawdown of at least one inch per hour at the planting surface.

A. **Development Community:** This change is not expected to affect pre-construction, footprint or construction costs associated with bioretention cells (0% pre-construction cost, 0% land cost and 0% construction cost).

B. **Owner:** This change is expected to slightly increase maintenance costs for the owner by (+5% maintenance cost).

#6 Planting plan requirements have been made more flexible and now state that the planting plan shall be designed to achieve 50% coverage with either canopy, ground cover, or a combination of canopy and ground cover at five years after planting. If sod is used, then it shall be a non-clumping, deep-rooted species.

A. **Development Community:** There will be a slight savings in designer time due to the more clear requirements for the planting plan. However, this change does not the amount of space that the bioretention cell takes up. This change is expected to reduce construction costs by eliminating the over-planting that often occurs in bioretention cells (-5% pre-construction cost, 0% land cost and -10% construction cost).

B. **Owner:** This change is expected to reduce maintenance costs for the owner by reducing the amount of pruning needed to maintain bioretention cells (-10% maintenance cost).

#7 There is a new requirement to provide an underdrain with internal water storage sunless it can be demonstrated that the in-situ soil infiltration rate is two inches per hour or greater immediately prior to the initial placement of the media. The internal water storage zone shall extend to a minimum of 18" below the planting surface.

A. **Development Community:** This change slightly increases designer effort but does not affect the amount of space that the bioretention cell takes up. There will be a slight increase in construction costs associated with buying and installing the underdrain system (+5% pre-construction cost, 0% land cost and +5% construction cost).

B. **Owner:** This change is expected to slightly increase maintenance costs for the owner by adding another component to the device that has to be checked and possibly maintained (+5% maintenance cost).

Costs and Benefits to the Environment of 2H .1052 MDC for Bioretention Cells:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. The proposed MDC for bioretention cells are designed to increase the effectiveness and durability of bioretention areas while also reducing unnecessary costs. While the environmental benefits associated with 2H .1052 MDC for Bioretention cells could be significant, we found that they are not readily quantifiable; as such, they could not be monetized.

The requirement to provide internal water storage in bioretention cells (except when installed in highly permeable soils) is an inexpensive addition to bioretention cell design that greatly increases the device's effectiveness at infiltrating stormwater. When rain falls in natural, undeveloped areas, the water is absorbed and filtered by soil and plants (US EPA, 2015). Infiltration is one of the most effective practices for protecting surface waters because it removes nearly all of the pollutants from stormwater while also helping to protect natural stream hydrology and structure. Often, streams in urban areas experience significant erosion due to the hydrologic changes associated with development activities.

The more detailed specification for the sand portion of the bioretention cell media is designed to make maintenance of these devices much easier without incurring much additional construction expense. The same can be said of the requirement to water or walk the media in place rather than compact it mechanically (and reduce the infiltration rate at the outset of the project). The previous planting plan requirements often resulted in an overgrown bioretention cell that was needlessly expensive at construction and required resources to maintain and prune.

The other changes from the baseline such as raising the P-index of the media and allowing for peak flow attenuation within the bioretention cells were judged by the MDC Team to reduce the costs of building and maintaining bioretention cells without impacting their function or durability. These changes are not anticipated to either benefit or harm the environment other than the possibility that removing barriers to infiltration systems may encourage their use. Choosing a bioretention cell over another type of SCM is likely to be beneficial to the environment.

Chapter 14: MDC for Wet Ponds

Citation & Summary

15A NCAC 2H .1053 MDC for Wet Ponds sets forth the minimum design criteria (MDC) for wet ponds, the most common type of stormwater control measure currently used in new development projects. The proposed updates to the current design of wet pond systems provide greater flexibility and typically reduce the size and cost of the system. Therefore, this rule is considered less stringent.

Baseline

The current design standards for infiltration systems are covered in two places: 2H .1008 and the Infiltration Device Chapter of the Stormwater BMP Manual, last updated in 2009. Based on its work in updating the Permeable Pavement Chapter in 2012, DEQ was aware that a number of updates to infiltration systems design standards were needed. The MDC Team discussed infiltration system MDC at length.

Changes from Baseline (items in blue analyzed in further detail below)

#1 In addition to using the SA/DA and Average Depth Method, designers may also use the Hydraulic Retention Time (HRT) Method, which allows for more flexibility with regard to pond geometry.

#2 There is no longer a requirement to place the permanent pool within 6 inches of the SHWT. If the outlet structure is set more than 6" below the SHWT, then per the General MDC for all SCMs, it shall be demonstrated that the SCM will not dewater waters of the state and that the treatment volume of the SCM will not be compromised by groundwater inflow.

#3 Sediment storage is required only in the forebay, not in the main pool.

#4 The required width of the vegetated shelf has been decreased from ten to six feet and may be located either directly above, directly below or so that it is bisected by the permanent pool. This shelf shall be no steeper than 6:1 (horizontal to vertical) and shall consist of native vegetation.

#5 There is a new requirement to provide a trash rack or other device shall be provided to prevent large debris from entering the outlet system.

#6 A level spreader-filter strip is no longer required at the outlet.

#7 The requirement for one foot of freeboard has been removed.

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-21,475
Owners	-450
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	**-21,925**

For more information on how these estimates were determined, see below and Appendix C.

Regulatory Impact of 2H .1053 MDC for Wet Ponds:

		Development Community			Owner
		Pre-const	Land	Const	Maint
#0	**Est. cost per wet pond** ($ for all costs except for maintenance, which is $/year)	37,216	36,539	124,054	2,481
#1	Allows use of the Hydraulic Retention Time (HRT) Method instead of SA/DA tables, which allows for more flexibility with regard to pond geometry.	+5%	-5%	-5%	0
#2	If the outlet structure is more than 6" below the SHWT, then the designer shall demonstrate that the SCM will not dewater waters of the state and that the volume of the SCM will not be compromised by groundwater inflow.	+5%	0	0	0
#3	Sediment storage is required only in the forebay, not in the main pool of the wet pond.	0	0	-5%	-10%
#4	The required width of the vegetated shelf has been decreased from ten to six feet and may be located either directly above, directly below or so that it is bisected by the permanent pool.	0	-5%	0	-5%
#5	There is a new requirement to provide a trash rack or other device to prevent large debris from entering the outlet system.	0	0	0	0
#6	A level spreader-filter strip is no longer required at the outlet of the wet pond.	-10%	-5%	-5%	-5%
#7	The requirement for one foot of freeboard has been removed.	0	0	0	0
	Total of all percentages (added sequentially)	0	-14%	-14%	-19%
	Est. difference in cost per practice ($)	0	-5,115	-17,368	-471
	Est. total difference in cost, 2014 (in $1,000) (900 wet ponds/year – 834 Local Gov, 66 State Gov)	0	-4,604	-15,631	-424
	Est. total difference in cost, 2017 (in $1,000)[11]	0	-4,886	-16,589	-450

[11] Difference in cost adjusted for inflation by 2% but not discounted

Justification for the above percentages:

#o Estimated cost per wet pond ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	11.98	acres	*DEQ, BIMS Jan-Dec 2014*
Average built-upon area (BUA) =	6.69	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	25,971	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 30%	$37,216	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$36,539	*Above data + 10% for easements*
Construction Cost	BUA * $18,550	$124,054	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$2,481	*King and Hagan, 2011*

#1 Allows use of the Hydraulic Retention Time (HRT) Method instead of SA/DA tables, which allows for more flexibility with regard to pond geometry.

A. Development Community: This change will slightly increase the amount of designer time, especially initially as designers become familiar with the HRT method. However, there are likely to be a reduction of space and the construction costs of wet ponds (+5% pre-construction cost, -5% land cost and -5% construction costs).

B. Owner: It is not anticipated that this change will affect the maintenance costs associated with wet ponds (0% maintenance cost).

#2 If the outlet structure is more than 6" below the SHWT, then the designer shall demonstrate that the SCM will not dewater waters of the state and that the volume of the SCM will not be compromised by groundwater inflow.

A. Development Community: This change will slightly increase the amount of designer time but will not affect the amount of space and the construction costs of the wet ponds (+5% pre-construction cost, 0% land cost and 0% construction costs).

B. Owner: It is not anticipated that this change will affect maintenance cost (0% maintenance cost).

#3 Sediment storage is required only in the forebay, not in the main pool of the wet pond.

A. Development Community: This change does not affect the designer time or the amount of space taken up by the wet pond. However, this change will decrease construction costs because the main pool of the pond will not need to be dug as deeply (0% pre-construction cost, 0% land cost and -5% construction costs).

B. Owner: The owner will need to check and clean out the forebay only rather than the entire pond; this will reduce maintenance efforts (-10% maintenance cost).

#4 The required width of the vegetated shelf has been decreased from ten to six feet and may be located either directly above, directly below or so that it is bisected by the permanent pool.

A. **Development Community:** This change does not affect the designer time associated with controlling peak flows; however, there are likely to be significant savings in the amount of space and the construction costs of the wet pond (0% pre-construction cost, -5% land cost and -5% construction costs).

B. **Owner:** The owner will be responsible for a smaller width of vegetated shelf (-5% maintenance cost).

#5 There is a new requirement to provide a trash rack or other device to prevent large debris from entering the outlet system.

A. **Development Community:** Although this has not been a requirement in the past, nearly all wet ponds are equipped with trash racks anyway as part of good engineering practice (0% pre-construction cost, 0% land cost and 0% construction costs).

B. **Owner:** See above (0% maintenance cost).

#6 A level spreader-filter strip is no longer required at the outlet of the wet pond.

A. **Development Community:** This change will reduce the designer time and the amount of space required for stormwater treatment since the wet pond will be sufficient by itself. There will also be a reduction in construction costs of the overall stormwater system (-10% pre-construction cost, -5% land cost and -5% construction costs).

B. **Owner:** The owner will not have the responsibility of maintaining a separate device to control peak flows (-5% maintenance cost).

#7 The requirement for one foot of freeboard has been removed.

A. **Development Community:** It is not anticipated that this change will have much impact on the design, sizing, construction, maintenance or review of wet ponds (0% pre-construction cost, 0% land cost and 0% construction costs).

B. **Owner:** See above (0% maintenance cost).

Costs and Benefits to the Environment of 2H .1053 MDC for Wet Ponds:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions, proposed 2H .1053 MDC for Wet Ponds will maintain existing environmental protections at a nearly equivalent level. The changes that were judged by the MDC Team to reduce the costs of building and maintaining wet ponds without impacting their function or durability include: allowing the Hydraulic Retention Time Method in addition to the SA/DA tables, designing the forebay to collect sediment (rather than the entire pond), removing the requirement for a level spreader-filter strip and removing the requirement for one foot of freeboard.

Chapter 15: MDC for Stormwater Wetlands

Citation & Summary

15A NCAC 2H .1054 MDC for Stormwater Wetlands sets forth the minimum design criteria (MDC) for stormwater wetlands. The proposed updates to the current design of stormwater wetlands provide greater flexibility and typically reduce the size and cost of the device. Therefore, this rule is considered less stringent.

Baseline

The current design standards for stormwater wetlands are covered in Stormwater Wetland Chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed stormwater wetland MDC at length.

Changes from Baseline (items in blue analyzed in further detail below)

#1 The ponding depth for the treatment volume has been increased from 12 to 15 inches above the permanent pool. The surface area shall be sized sufficiently to limit the ponding depth to 15 inches.

#2 The wetland may be designed to temporarily pond peak attenuation volume at a depth exceeding 15 inches.

#3 There is a new requirement that the pH, compaction and other attributes of the first 12" depth of the soil shall be adjusted if necessary to promote plant establishment and growth.

#4 There is a new requirement to provide a trash rack or other device to trap debris shall be provided on piped outlet structures.

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-2,668
Owners	-41
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	**-2,709**

For more information on how these estimates were determined, see below and Appendix C.

Regulatory Impact of 2H .1054 MDC for Stormwater Wetlands:

		Development Community			Owner
		Pre-const	Land	Const	Maint
#0	Estimated cost per stormwater wetland ($ for all costs except for maintenance, which is $/year)	5,611	10,821	18,702	374
#1	The ponding depth for the treatment volume has been increased from 12 to 15 inches above the permanent pool. The surface area shall be sized sufficiently to limit the ponding depth to 15 inches.	-5%	-10%	-10%	0
#2	The wetland may be designed to temporarily pond peak attenuation volume at a depth exceeding 15 inches.	0	-10%	-10%	-10%
#3	There is a new requirement that the pH, compaction and other attributes of the first 12" depth of the soil shall be adjusted if necessary to promote plant growth.	+5%	0	+5%	-10%
#4	There is a new requirement to provide a trash rack or other device to trap debris shall be provided on piped outlet structures.	0	0	0	0
	Total of all percentages (added sequentially)	0	-19%	-14%	-19%
	Est. difference in cost per practice ($)	0	-2,056	-2,618	-72
	Est. total difference in cost, 2014 (in $1,000) (538 wetlands/year – 530 Local Gov, 8 State Gov)	0	-1,106	-1,408	-39
	Est. total difference in cost, 2017 (in $1,000)[12]	0	-1,174	-1,494	-41

Justification for the above percentages:

#o Estimated cost per stormwater wetland ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	2.39	acres	*DEQ, BIMS Jan-Dec 2014*
Average built-upon area (BUA) =	1.01	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	7,691	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 30%	$5,611	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$10,821	*Above data + 10% for easements*
Construction Cost	BUA * $18,550	$18,702	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$374	*King and Hagan, 2011*

[12] Difference in cost adjusted for inflation by 2% but not discounted

#1 The ponding depth for the treatment volume has been increased from 12 to 15 inches above the permanent pool. The surface area shall be sized sufficiently to limit the ponding depth to 15 inches.

A. Development Community: There will savings in the designer time, the amount of space and the construction costs of the wetland due to its needing a smaller footprint to control the design storm (-5% pre-construction cost, -10% land cost and -10% construction cost).

B. Owner: It is not anticipated that this change will affect maintenance costs (0% maintenance cost).

#2 The wetland may be designed to temporarily pond peak attenuation volume at a depth exceeding 15 inches.

A. Development Community: This change does not affect the designer time associated with controlling peak flows; however, there are likely to be significant savings in the amount of space and the construction costs of the overall stormwater system because the development community will not need a separate device to control peak flows (0% pre-construction cost, -10% land cost and -10% construction costs).

B. Owner: The owner will not have the responsibility of maintaining a separate device to control peak flows (-10% maintenance cost).

#3 There is a new requirement that the pH, compaction and other attributes of the first 12" depth of the soil shall be adjusted if necessary to promote plant establishment and growth.

A. Development Community: This change does slightly increases the designer time associated with testing and specifying appropriate soil amendments. There is no impact on the amount of space taken up by the wetland. There will be a slight increase in construction cost associated with providing and applying the soil amendments (+5% pre-construction cost, 0% land cost and +5% construction costs).

B. Owner: This change is anticipated to improve plant survival rates and thus decrease maintenance costs associated with replacing dead and diseased plants (-10% maintenance cost).

#4 There is a new requirement to provide a trash rack or other device to trap debris shall be provided on piped outlet structures.

A. Development Community: Although this has not been a requirement in the past, nearly all stormwater wetlands are equipped with trash racks anyway as part of good engineering practice (0% pre-construction cost, 0% land cost and 0% construction costs).

B. Owner: See above (0% maintenance cost).

Costs and Benefits to the Environment of 2H .1054 MDC for Stormwater Wetlands:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions, proposed 2H .1054 MDC for Stormwater Wetlands will maintain existing environmental protections at a nearly equivalent level. The changes that were judged by the MDC Team to reduce the costs of building and maintaining stormwater wetlands without impacting their function or durability include: allowing the ponding depth for the design volume to increase from 12 inches to 15 inches and allowing peak attenuation control within the footprint of the wetland.

The requirement to adjust the pH, compaction and other attributes of the first 12 inches of the soil depth is likely to improve the survival and growth of vegetation within the wetland; however, the environmental benefits associated with this change are not readily monetized.

Chapter 16: MDC for Permeable Pavement

Citation & Summary	**15A NCAC 2H .1055 MDC for Permeable Pavement** sets forth the minimum design criteria (MDC) for permeable pavement. The proposed updates to the current design of permeable pavement systems provide greater flexibility and typically reduce the required treatment volume of other SCMs. Therefore, this rule is considered less stringent.
Baseline	The current design standards for permeable pavement is covered in the Permeable Pavement chapter of the Stormwater BMP Manual, last updated in 2014. The MDC Team discussed permeable pavement MDC at length (45 pages of design, construction and maintenance information).
Changes from Baseline	**#1** Because this chapter was updated so recently, the MDC in the proposed rule consist of edits to the current standards without implementing significant changes (de minimis impact). **#2** Signage is no longer required; however, this is a minimal expense compared with the overall cost of the permeable pavement system (de minimis impact). **#3** 2H .1055(7)(a) excludes screened runoff from the 1:1 loading ratio limit. This is a potential savings to the development community; however, it is not possible to predict how many developers will choose to use this additional flexibility on their development projects (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for a permeable pavement system thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes will also provide additional flexibility to the development community in terms of permeable pavement system design options and signage requirements. These changes will be

voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to take advantage of this additional flexibility, there could be a potential savings. We do not, however, have data on which to base an analysis of the potential economic benefit to the development community.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 17: MDC for Sand Filters

Citation & Summary

15A NCAC 2H .1056 MDC for Sand Filters sets forth the minimum design criteria (MDC) for sand filters, the most common type of stormwater control measure currently used in new development projects. The proposed updates to the current design of sand filter systems provide greater flexibility and will typically reduce the size of the device and the cost associated with its use. Therefore, this rule is considered less stringent.

Baseline

The current design standards for sand filters are covered in Sand Filter Chapter of the Stormwater BMP Manual, last updated in 2009. Sand filters are used on fewer than ten percent of new development projects that are subject to state stormwater requirements. Their main application is on highly urban projects where land costs are high. It seems likely that the use of sand filters may increase in the future as land costs increase and our state becomes more urbanized. The MDC Team discussed sand filter MDC at length.

Changes from Baseline (items in blue analyzed in further detail below)

#1 Sand filters may store peak attenuation volume above the treatment volume depth.

#2 The method for sizing sand filters has been greatly simplified as follows: The volume of water that can be stored in the sediment chamber and the sand chamber above the sand surface combined shall be 0.75 times the treatment volume. The elevation of bypass devices shall be set above the ponding depth associated with this volume.

#3 A new specification has been added: the sand media shall meet ASTM C33. The requirement for the sand filter to drain within 40 hours has been removed because the media will achieve that goal.

Regulatory Impact

	Projected for 2017 (in $1,000)
Development Community	-66.3
Owners	-9.3
Local Governments	0
State Government	0
NC Department of Transportation	0
TOTALS	**-75.6**

For more information on how these estimates were determined, see below and Appendix C.

Regulatory Impact 0f 2H .1056 MDC for Sand Filters:

		Development Community			Owner
		Pre-const	Land	Const	Maint
#0	Estimated cost per sand filter ($ for all costs except for maintenance, which is $/year)	17,355	9,469	43,389	868
#1	Sand filters may store peak attenuation volume above the treatment volume depth.	0	0	-5%	-10%
#2	The method for sizing sand filters has been greatly simplified as follows: The volume of water that can be stored in the sediment chamber and the sand chamber above the sand surface combined shall be 0.75 times the treatment volume. The elevation of bypass devices shall be set above the ponding depth.	-10%	0	0	0
#3	A new specification has been added: the sand media shall meet ASTM C33. The requirement for the sand filter to drain within 40 hours has been removed because the media will achieve that goal.	0	0	+5%	-5%
	Total of all percentages (added sequentially)	-10%	0	0	-14%
	Est. difference in cost per practice ($)	-868	0	0	-122
	Est. total difference in cost, 2014 (in $1,000) (72 sand filters/year – 65 Local Gov, 7 State Gov)	-62.5	0	0	-8.8
	Est. total difference in cost, 2017 (in $1,000)[13]	-66.3	0	0	-9.3

Justification for the Values in the Table Above:

#o Estimated cost per sand filter ($ for all costs except for maintenance, which is $/year)

Average drainage area (DA) =	2.44	acres	*DEQ, BIMS Jan-Dec 2014*
Average built-upon area (BUA) =	1.08	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	6,730	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 40%	$17,355	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$9,469	*Above data + 10% for easements*
Construction Cost	BUA * $40,000	$43,389	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$868	*King and Hagan, 2011*

[13] Difference in cost adjusted for inflation by 2% but not discounted

#1 Sand filters may store peak attenuation volume above the treatment volume depth.

A. Development Community: This change does not affect the designer time associated with controlling peak flows and may not affect land costs; however, there are likely to be savings in the amount the construction costs of the overall stormwater system because the development community will not need a separate device to control peak flows (0% pre-construction cost, 0% land cost and -10% construction costs).

B. Owner: The owner will not have the responsibility of maintaining a separate device to control peak flows (-10% maintenance cost).

#2 The method for sizing sand filters has been greatly simplified as follows: The volume of water that can be stored in the sediment chamber and the sand chamber above the sand surface combined shall be 0.75 times the treatment volume. The elevation of bypass devices shall be set above the ponding depth associated with this volume.

A. Development Community: This change will reduce the pre-construction cost for sand filters but it is not likely the change the footprint or the corresponding construction cost (-10% pre-construction cost, 0% land cost and 0% construction costs).

B. Owner: It is not anticipated that this change will affect maintenance efforts associated with sand filters (0% maintenance cost).

#3 A new specification has been added: the sand media shall meet ASTM C33. The requirement for the sand filter to drain within 40 hours has been removed because the media will achieve that goal.

A. Development Community: This change does not affect the level of designer effort or the amount of space that the sand filter takes up. However, there will be a slight increase in construction costs associated with checking the media to ensure that it meets the specification upon delivery (0% pre-construction cost, 0% land cost and +5% construction cost).

B. Owner: This change is expected to reduce maintenance costs for the owner by addressing media clogging, which is the most frequent maintenance issue associated with sand filters (-5% maintenance cost).

Costs and Benefits to the Environment of 2H .1056 MDC for Sand Filters:

The primary purpose of the EMC's stormwater rules is to protect the surface waters of North Carolina from pollution caused by stormwater runoff. As measured from the baseline conditions, proposed 2H .1056 MDC for Sand Filters will maintain existing environmental protections at a nearly equivalent level. The changes that were judged by the MDC Team to reduce the costs of building and maintaining stormwater wetlands without impacting their function or durability include: allowing the ponding depth for the design volume to increase from 12 inches to 15 inches and allowing peak attenuation control within the footprint of the wetland.

The requirement to adjust the pH, compaction and other attributes of the first 12 inches of the soil depth is likely to improve the survival and growth of vegetation within the wetland; however, the environmental benefits associated with this change are not readily monetized.

Chapter 18: MDC for Rainwater Harvesting

Citation & Summary	**15A NCAC 2H .1057 MDC for Rainwater Harvesting** sets forth the minimum design criteria (MDC) for rainwater harvesting systems. The proposed updates to the current design of rainwater harvesting systems provide greater flexibility and typically reduce the required treatment volume of other SCMs. Therefore, this rule is considered less stringent.
Baseline	The current design standards for rainwater harvesting are covered in Rooftop Runoff Management chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed rainwater harvesting at a special meeting for members with specific interest in this practice (about one-half of the team.) Currently, rainwater harvesting is rarely used as a stormwater control measure on state-issued stormwater permits. There have been no permit applications that have included a rainwater harvesting system during the past five years.
Changes from Baseline	The proposed changes to the rainwater harvesting MDC make it easier and more straightforward to treat stormwater on a high density development site using rainwater harvesting. This is a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use this option and therefore to quantify the potential savings (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for rainwater harvesting system thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes may make rainwater harvesting a more attractive option for stormwater treatment. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to incorporate rainwater harvesting into their project, there could be a potential savings over the baseline. We do not, however,

have data on which to base an analysis of the potential economic benefit to the development community.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 19: MDC for Green Roofs

Citation & Summary	**15A NCAC 2H .1058 MDC for Green Roofs** sets forth the minimum design criteria (MDC) for green roofs. Green roofs are a system where a rooftop is equipped with planting media and plants to capture and evapo-transpire stormwater. The proposed updates to the current design of green roofs provides greater flexibility in the required treatment of stormwater. Therefore, this rule is considered less stringent.
Baseline	The current design standards for green roofs are covered in Rooftop Runoff Management chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed green roofs at a special meeting for members with specific interest in this practice (about one-half of the team.) Currently, green roofs are only rarely used as a stormwater control measure on state-issued stormwater permits. There have been no permit applications that have included a green roof during the past five years.
Changes from Baseline	The proposed changes to the green roof MDC make it easier and more straightforward to treat stormwater on a high density development site using a green roof. This is a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use this option and therefore to quantify the potential savings (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for green roof systems thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes may make green roofs a more attractive option for stormwater treatment. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to

incorporate green roofs into their project, there could be a potential savings over the baseline. We do not, however, have data on which to base an analysis of the potential economic benefit to the development community.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 20: MDC for Level Spreader-Filter Strips

Citation & Summary	**15A NCAC 2H .1059 MDC for Level Spreader-Filter Strips** sets forth the minimum design criteria (MDC) for level spreader-filter strips. The proposed updates to the current design of level spreader-filter strips provide greater flexibility and typically reduce the size of primary SCMs. Therefore, this rule is considered less stringent.
Baseline	Technical design standards for level spreader-filter strips are contained in the Level Spreader-Vegetated Filter Strip chapter of the Stormwater BMP Manual, last updated in 2010. The team discussed level spreader-filter strip MDC at length.
Changes from Baseline	The proposed changes to the MDC for level spreader-filter strips provide more flexibility to the development community to use treatment swales on high density development sites to reduce the size of the primary SCM. The updated design pertains only to level spreader-filter strips that are designed to remove pollutants, with a 30-foot wide engineered (grassed and graded) filter strip. In the past, level spreaders have been used to meet the diffuse flow requirements of the riparian buffer rules; however, these rules are being re-written and level spreaders will likely no longer be allowed to be used as stand-alone devices to meet diffuse flow standards. Therefore, that application of level spreaders is not considered in either the proposed 2H .1059 rule language or in this regulatory impact analysis. The proposed changes result in a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use level spreader-filter strips to reduce the size of the primary SCM and therefore to quantify the potential savings associated with this rule. The primary changes are as follows: **#1** Level spreader-filter strips that receive flow directly from the drainage area shall be sized based on the flow rate during the 0.75 inch/hour storm, with a flow bypass system for larger storm events. This is a reduction from the previous requirement of the 1.0 inch/hour storm intensity. This change would reduce the size of the level spreader-filter strip system by 25%; however, it is not possible to quantify if and how frequently this allowance would be used (de minimis). **#2** The blind swale portion of the level spreader-filter strip shall be sufficient to provide pre-treatment. Additional pretreatment is optional (de minimis).

	#3 The requirement for the levelness of the level spreader has been clarified as follows: The lip of the level spreader shall be at a uniform elevation with a construction tolerance of plus or minus ¼" at any point along its length. The level spreader shall be constructed of concrete or other stable material (de minimis).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for level spreader-filter strip systems thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes may make level spreaders-filter strips a more attractive option for stormwater treatment. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to incorporate level spreaders-filter strips into their project, there could be a potential savings over the baseline. We do not, however, have data on which to base an analysis of the potential economic benefit to the development community. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT. Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 21: MDC for Disconnected Impervious Surfaces

Citation & Summary	**15A NCAC 2H .1061 MDC for Disconnected Impervious Surfaces (DIS)** sets forth the minimum design criteria (MDC) for disconnected pavement and rooftops. The proposed updates to the current design of DIS provide greater flexibility and typically reduce the required treatment volume of other SCMs. Therefore, this rule is considered less stringent.
Baseline	Technical design standards for disconnected impervious surfaces are contained in Disconnected Impervious Surface chapter of the Stormwater BMP Manual, last updated in 2014. Disconnected impervious surfaces do not receive "full treatment credit," but can help to reduce the required treatment volume of other SCMs. The MDC Team discussed design criteria for DIS at length. Currently, disconnected impervious surface is only rarely used as a stormwater control measure on state-issued stormwater permits. There have been no permit applications that have included disconnected impervious surface since the new chapter was issued.
Changes from Baseline	The proposed changes to the MDC for DIS provide more flexibility to the development community to use DIS on high density development site to reduce the size of the primary SCM. This is a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use this option and therefore to quantify the potential savings (de minimis impact).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for DIS thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes may make DIS a more attractive option for stormwater treatment. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to incorporate DIS into their

project, there could be a potential savings over the baseline. We do not, however, have data on which to base an analysis of the potential economic benefit to the development community.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 22: MDC for Treatment Swales

Citation & Summary	**15A NCAC 2H .1061 MDC for Treatment Swales** sets forth the minimum design criteria (MDC) for vegetated swales that are specifically designed for stormwater treatments. The proposed updates to the current design of treatment swales provide greater flexibility and typically reduce the footprint of the swale. Therefore, this rule is considered less stringent.
Baseline	The current design standards for treatment swales are covered in Grassed Swale Chapter of the Stormwater BMP Manual, last updated in 2009. The MDC Team discussed treatment swale MDC at length.
Changes from Baseline	The proposed changes to the MDC for treatment swales provide more flexibility to the development community to use treatment swales on high density development sites to reduce the size of the primary SCM. This is a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use this option and therefore to quantify the potential savings (de minimis impact). The primary changes are as follows: **#1** Swales no longer are required to be 150 feet in length, longitudinal slope is not limited to 5 percent, and flow velocity is not limited to 1 foot/second. The slope and length for pollutant removal swales shall be determined based on a design storm intensity shall be 0.75 inch/hour, a hydraulic residence time of 4 minutes and a flow depth of 6 inches or less (de minimis impact). **#2** Cross-sectional side slopes stabilized with vegetative cover shall be no steeper than 3:1 (horizontal to vertical) rather than the previous requirement of 5:1. Steeper vegetated slopes may be considered on a case-by-case basis provided that it is demonstrated that the soils and vegetation will remain stable in perpetuity (de minimis impact).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for treatment swales thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant

financial benefit; however, it is noted here for completeness. The proposed changes may make treatment swales a more attractive option for stormwater treatment. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to incorporate treatment swales into their project, there could be a potential savings over the baseline. We do not, however, have data on which to base an analysis of the potential economic benefit to the development community.

These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Chapter 23: MDC for Dry Ponds

Citation & Summary	**15A NCAC 2H .1062 MDC for Dry Ponds** sets forth the minimum design criteria (MDC) for dry ponds. The proposed updates to the current design of dry ponds provide greater flexibility and may reduce the required treatment volume of a primary SCM. Therefore, this rule is considered less stringent.
Baseline	The current design standards for dry ponds are covered in the Dry Detention Pond chapter of the Stormwater BMP Manual, last updated in 2009. Dry ponds may not be used as the primary means of treating stormwater on a development site, but instead must be combined with another practice to meet state standards. BIMS data show that dry ponds have been used infrequently on new development sites that are subject to state stormwater regulations. The main application for dry ponds at present is for controlling peak flows associated with larger storm events rather than stormwater quality treatment.
Changes from Baseline	Dry ponds retain their status as "partial treatment" stormwater devices. However, the proposed changes to the dry pond MDC provide more clarity and flexibility in designing dry ponds. This is a potential savings for the development community; however, it is not possible to anticipate how many applicants will choose to use this option and therefore to quantify the potential savings (de minimis impact).
Regulatory Impact	These changes provide clarification of existing rules and policies that are already being fully implemented by DEQ. None of these changes will require DEQ or local governments to revise their existing procedures or to procure additional staff; as such, there should be no economic cost to state agencies or local governments. The proposed changes will provide clarity as to design standards for dry ponds thereby making the rule easier to understand. This should translate into less time spent by the development community on the permit application process as well as less time spent by regulatory staff providing technical assistance. The amount of time saved will be inconsequential and will not represent a significant financial benefit; however, it is noted here for completeness. The proposed changes may make dry ponds a more attractive option for controlling peak flows. However, these changes will be voluntary and will not require the development community to deviate from current practices. As such, there should be no economic costs to the development community. If the development community chooses to incorporate dry ponds into their project, there could be a potential savings over the baseline. We

do not, however, have data on which to base an analysis of the potential economic benefit to the development community. These changes will not affect environmental permitting of NC Department of Transportation (NCDOT); as such there should be no economic impact to NCDOT.

Lastly, as measured from the baseline conditions, the changes will maintain existing environmental protections at an equivalent level with no cost or benefit to the environment.

Appendix A: References

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Appendix B: Glossary

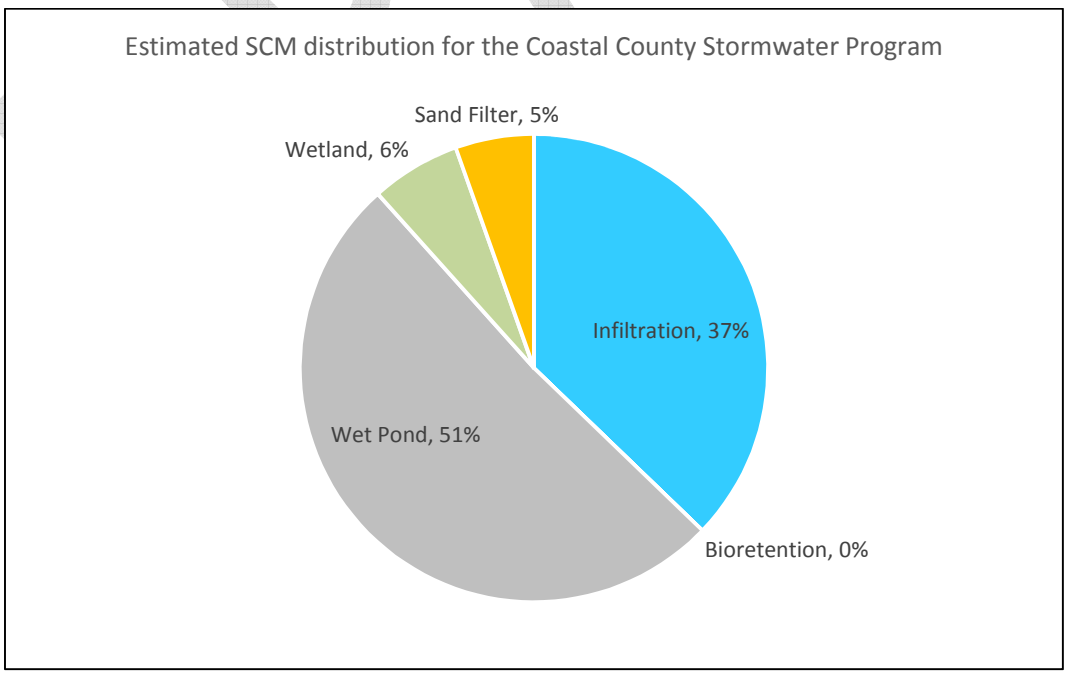
1. *Coastal Counties* means any of the following counties: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington.
2. *Construction costs* means the costs of capital, labor, material and overhead costs, but not including land costs.
3. *Design volume* means the amount of stormwater runoff that an SCM or series of SCMs is designed to treat in accordance with the applicable minimum design criteria.
4. *Land costs* means the opportunity cost of developable land associated with the footprint of SCMs. For the purpose of this analysis, land costs are estimated as $55,700 per acre (average value of developed land in North Carolina) times 1.1 to account for the 10-foot easements required around the perimeter of SCMs.
5. *Maintenance Costs* means the expense of routine annual maintenance for SCMs (such as mowing and pruning) plus average annual intermittent maintenance costs (such as cleaning a full forebay).
6. *Minimum Design Criteria* or *MDC* means all requirements for siting, site preparation, design and construction, and post-construction monitoring and evaluation necessary for the Department to issue stormwater permits that comply with State water quality standards adopted pursuant to G.S. 143-214.1.
7. *90th percentile rainfall event* means the event whose precipitation total is greater than or equal to 90 percent of all 24-hour storms on an annual basis.
8. *95th percentile rainfall* event means the event whose precipitation total is greater than or equal to 95 percent of all 24-hour storms on an annual basis.
9. *One-year, 24-hour storm* means a rainfall of an intensity expected to be equaled or exceeded, on average, once in 12 months and with a duration of 24 hours.
10. *Peak attenuation control* means releasing stormwater runoff in excess of the design volume from an SCM in a controlled manner to address potential downstream erosion and flooding impacts to meet federal, state or local regulations beyond the requirements of this Section.
11. *Pre-construction costs* means the costs of surveying, design, planning, permitting, which tend to range from 20% to 40% of SCM construction costs.
12. *Runoff volume match* means that the volume of runoff after development does not exceed the amount of runoff before development.
13. *Stormwater Control Measure* or *SCM* means a permanent engineered or vegetated device that is designed, constructed, and maintained to remove pollutants from stormwater runoff or to mimic the natural hydrologic cycle by promoting infiltration, evapo-transpiration, post-filtration discharge, reuse of stormwater, or a combination thereof.

Appendix C: Methodology

Step 1: Estimate the number, types and built-upon areas treated by SCMs approved under the Coastal Counties stormwater program.

The data for 2014 were collected from the Basinwide Information Management System (BIMS). This BIMS data was then sorted by type of SCM (infiltration, wet ponds, wetlands and sand filters, no bioretention cells were approved in the Coastal Counties). The numbers of each type of SCM were counted. The surface areas and built-upon areas draining to each SCM were averaged. A discount factor of 0.8 was applied based on the assumption that only 80% of the approved devices would be constructed (Best Professional Judgement).

SCM	Percentage	Average surface area (sq feet)	Average BUA draining to SCM (acres)	SCMs approved by DEQ (#/year)	SCMs approved by DEQ, discounted by 0.8 (#/year)
Infiltration	37%	6,480	1.15	60	48
Bioretention	0%	7,976	2.62	0	0
Wet Pond	51%	25,971	6.68	83	66
Wetland	6%	7,691	1.01	10	8
Sand Filter	5%	6,730	1.08	9	7
Total SCMs	100%	--	--	161	129

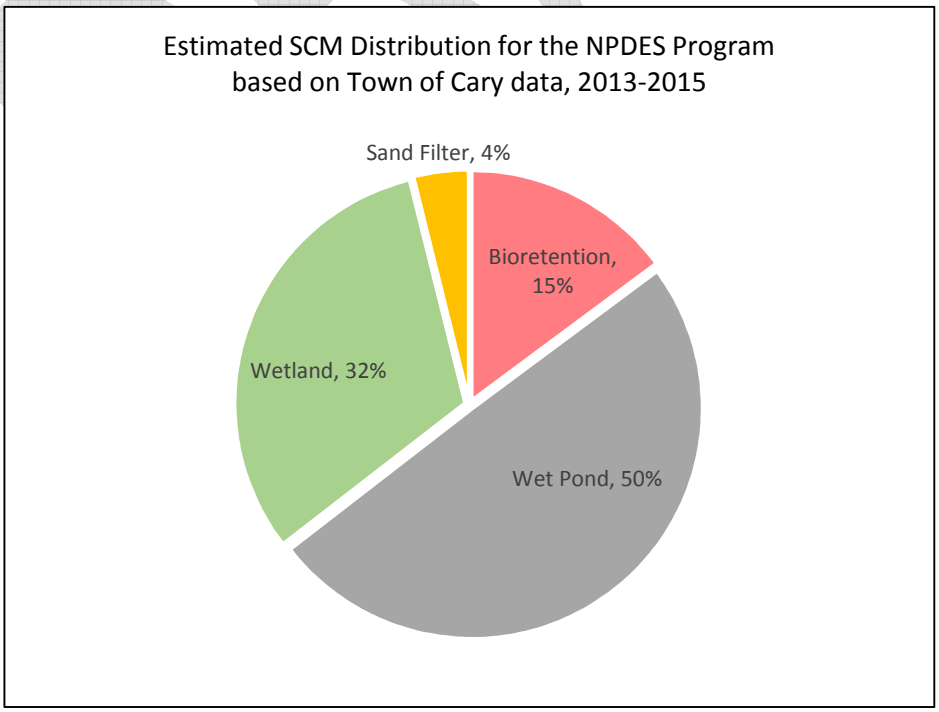


Step 2: Estimate the number and types of SCMs treated by SCMs approved under the NPDES stormwater program.

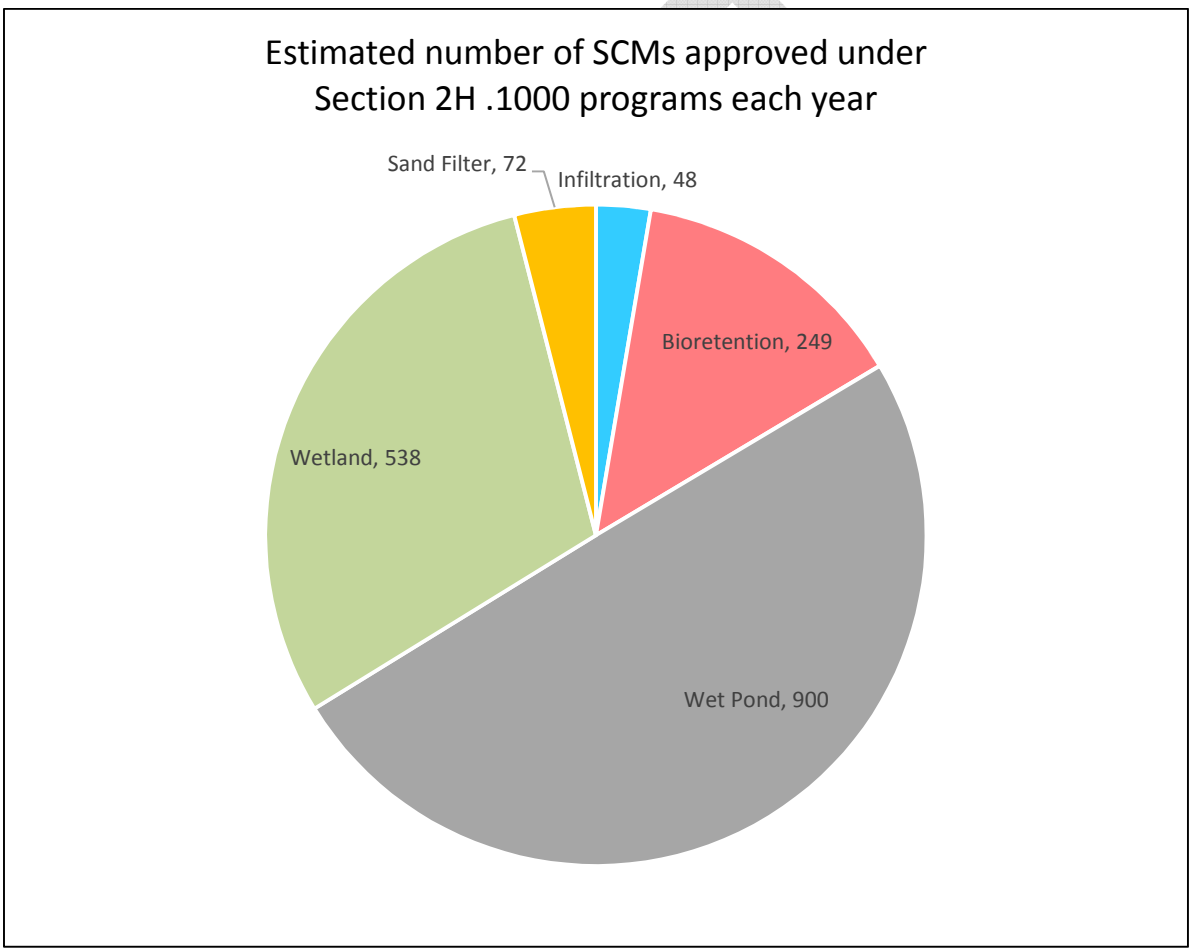
DEQ made a number of requests to municipalities, but the Town of Cary was the only one who responded with a detailed spreadsheet that included all of the SCMs that they had approved during 2013-1015. Therefore, DEQ decided to extrapolate the Town's data to all of the other NPDES local governments in the state. Since the population growth of Town of Cary from April 2010 through July 2014 is estimated at 9.52% and the population growth of all municipalities is estimated at 5.66% for the same time period, a discount factor of 5.66/9.52, or 0.59, was applied to the Town's data. A second discount factor of 0.8 was applied to the data to represent that only 80% of the approved SCMs are actually built.

Area in Cary =	56.31	square miles	Town of Cary, 2013
Areas subject to NPDES =	3,845	square miles	DEQ, Dec 2015
Scale-up factor =	68.28		
Est 4/2010-7/2014 pop growth, Cary =	9.52	%	OSBM, July 2014
Est 4/2010-7/2014 pop growth, total of NC munis =	5.66	%	OSBM, July 2014
Discount factor for Cary's above-average growth rate =	0.59		
Discount factor for SCMs approved by not built =	0.80		

SCM	Percentage	SCMs in Cary (#/3 years)	SCMs in Cary (#/yr)	SCMs subject to NPDES (#/yr)
Bioretention	15%	23	8	249
Wet Pond	50%	77	26	834
Wetland	32%	49	16	530
Sand Filter	4%	6	2	65
Total SCMs	100%	155	52	1678



SCM	SCMs subject to Coastal SW (est. #/yr)	SCMs subject to NPDES (est. #/yr)	Total	% of Total
Infiltration	48	0	48	3%
Bioretention	0	249	249	14%
Wet Pond	66	834	900	50%
Wetland	8	530	538	30%
Sand Filter	7	65	72	4%
Total SCMs	129	1,678	1,807	100%



Step 3: Estimate the per-SCM costs existing costs for pre-construction, land, construction, and maintenance.

For this task, the cost estimating spreadsheet entitled "Costs of Stormwater Management Practices in Maryland Counties" prepared for Maryland Department of the Environment by Dennis King and Patrick Hagan of the University of Maryland, Center for Environmental Science (UMCES) was consulted. It is available at:
www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/PhaseIIBayWIPDev.aspx

See the tables below for information on how this method was applied to North Carolina data. Please note that BIMS data was used for the average drainage area, average impervious and average surface area numbers. Land value was based on the average value of "developed" land in William Larson, US Department of Commerce, Bureau of Economic Analysis, April 2015. New Estimates of Value of Land of the United States. https://www.bea.gov/papers/pdf/new-estimates-of-value-of-land-of-the-united-states-larson.pdf, which was $55,714 per acre.

The tables below also appear in chapters 5. 12-15, and 17.

Infiltration Systems

Average drainage area (DA) =	1.9	acres	*DEQ, BIMS Jan-Dec 2014*
Average BUA =	1.15	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA) =	6,480	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 40%	$19,244	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$9,117	*Above data + 10% for easements*
Construction Cost	BUA*$41,750	$48,111	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 1%	$481	*King and Hagan, 2011*

Bioretention Cells

Average drainage area (DA) =	3.76	acres	*Town of Cary, Jan 2014 -Dec 2015*
Average imperviousness =	2.62	acres	*Town of Cary, Jan 2014 -Dec 2015*
Average surface area (SA)	7,976	square feet	*Town of Cary, Jan 2014 -Dec 2015*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 25%	$24,563	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$11,222	*Above data + 10% for easements*
Construction Cost	BUA*$37,500	$98,250	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$1,965	*King and Hagan, 2011*

Wet Ponds

Average drainage area (DA) =	11.98	acres	*DEQ, BIMS Jan-Dec 2014*
Average imperviousness =	6.69	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	25,971	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 30%	$37,216	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$36,539	*Above data + 10% for easements,*
Construction Cost	BUA*$18,550	$124,054	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$2,481	*King and Hagan, 2011*

Stormwater Wetland

Average drainage area (DA) =	2.39	acres	*DEQ, BIMS Jan-Dec 2014*
Average imperviousness =	1.01	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	7,691	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 30%	$5,611	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$10,821	*Above data + 10% for easements, etc.*
Construction Cost	BUA*$18,550	$18,702	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$374	*King and Hagan, 2011*

Sand Filter

Average drainage area (DA) =	2.44	acres	*DEQ, BIMS Jan-Dec 2014*
Average imperviousness =	1.08	acres	*DEQ, BIMS Jan-Dec 2014*
Average surface area (SA)	6,730	square feet	*DEQ, BIMS Jan-Dec 2014*
Land Value (LV) =	$55,714	value/acre	*Larson, 2015*

	Formula	Cost	Source
A. Development Community:			
Pre-Construction Cost	CC * 40%	$17,355	*King and Hagan, 2011*
Land Cost	SA * LV * 1.1	$9,469	*Above data + 10% for easements, etc.*
Construction Cost	BUA*$40,000	$43,389	*King and Hagan, 2011*
B. Owner:			
Maintenance Cost	CC * 2%	$868	*King and Hagan, 2011*

Step 4: For each proposed change from baseline, estimate the resulting change to for pre-construction, land, construction, and maintenance.

This step appears in chapters 5. 12-15, and 17, where a table for each SCM is provided and the impact (costs in red and savings in green) is listed next to each change. These estimates are based on the best professional judgement of one of the MDC members with 20 years of experience as a consulting engineer. An effort was made to estimate all benefits resulting from the rule changes conservatively. A brief explanation of each judgement was provided in the chapters.

Step 5: Sum the percentage changes to the costs of pre-construction, land, construction, and maintenance sequentially.

The percentages of costs and benefits were summed sequentially to avoid overestimating the benefits of the proposed rule changes. For example, if the first change resulted in a savings in construction cost of 10%, we "discounted the discount;" that is, a second savings of 10% was only computed as a total of 19% savings rather than a full 20% in savings.

Step 6. Apply the total percent change to the costs of pre-construction, land, construction, and maintenance to the per-SCM existing costs.

This step appears in chapters 5. 12-15, and 17, where a table for each SCM is provided and the TOTAL impact (costs in red and savings in green) is listed for each category of cost (pre-construction, land, construction, and maintenance).

Step 7. Apply a two percent interest rate to project the 2014 cost estimates to 2017.

Appendix D: Proposed Rule Language

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2H Stormwater Rules