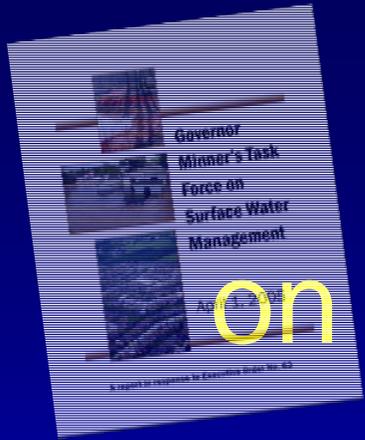


***Revisions to the
Delaware Sediment & Stormwater Regulations***

Regulatory Advisory Committee Meeting

February 25, 2013

DeIDOT Felton-Farmington Room

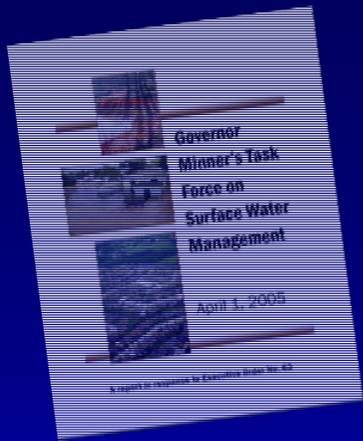


Task Force on Surface Water Management

- Specific Recommendations for Drainage & Stormwater Section

Guiding Principals

- Peak-based to Volume-based management
- Site-level to Watershed-level management
- Separate regulatory language from technical requirements
- Streamline plan review/approval process

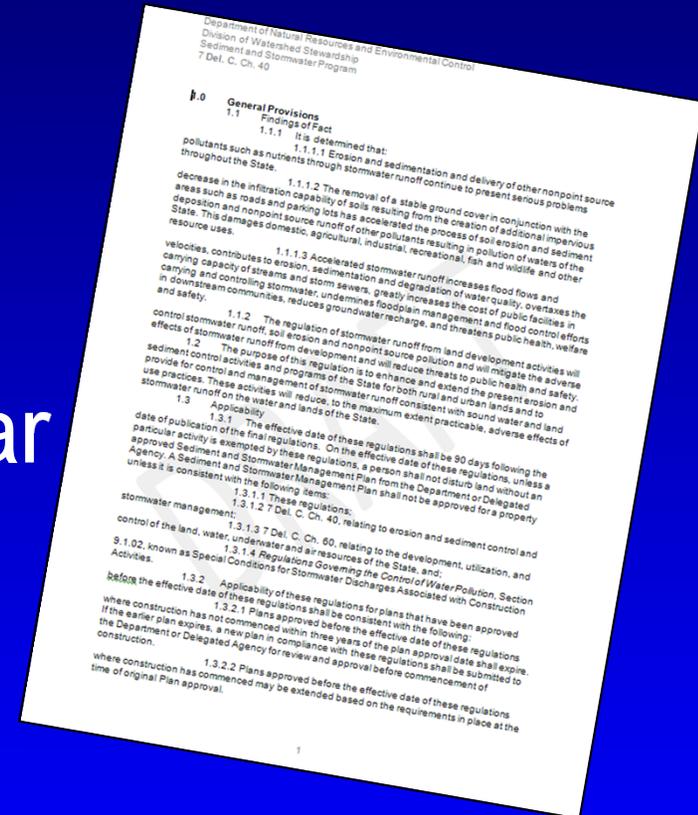


History of Reg Revisions

- Governor's Task Force – April 2005
- RAC first meeting – October 2007
- Reg Revisions Outline – January 2008
- First Working Draft – February 2009
- Second Draft – May 2010
- Draft Technical Document – Sept 2010
- Final Draft – June 2011

History of Reg Revisions

- Final Technical Document
– January 2012
- Regs Published in Registrar
– February 2012
- Public Hearing
– March 1, 2012
- Comment Period Closed
– March 30, 2012



By the Numbers: Outreach

- Prior to Public Hearing:
 - RAC Meetings: 8
 - Subcommittee Meetings: 37
(Technical Subcommittee: 20 meetings)
 - Interested Parties: 223

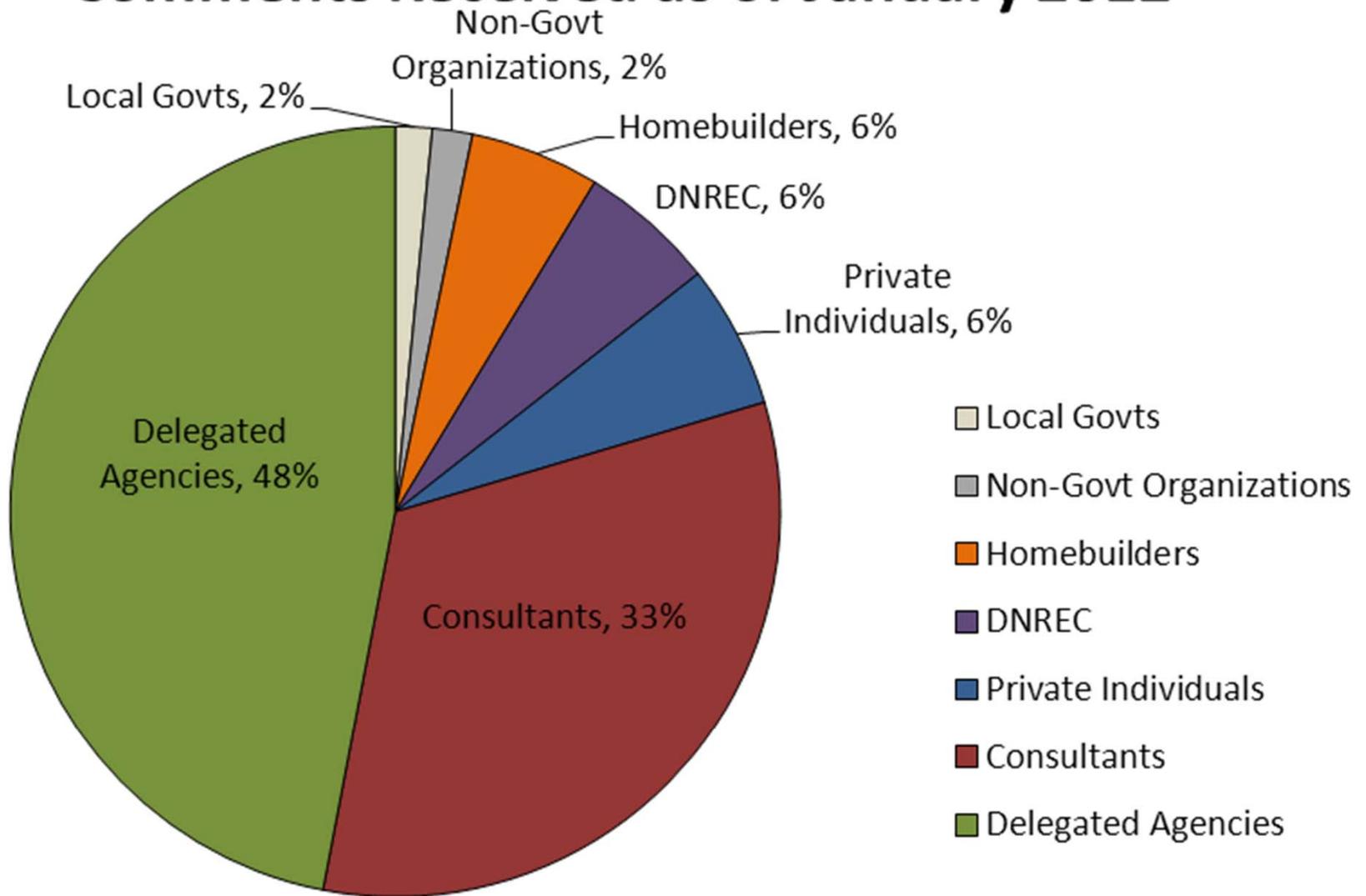
By the Numbers: Comments

Reg Revisor	Date Comm	Section Number	Subsection	Commenter	Comment	Subcomment	Comment Response	Response Date	Responder
Technical Docu	5/5/2011	Technical Document Article 4	4.05 - Project C	Mike Sisteck, CI	The burden of seni		The Notice of Completion is the	5/27/2011	E. Webb
Apr 2011 3rd Di	5/5/2011	General Comment		Mike Sisteck, CI	It is not felt that th		9.1.2 has been added in the Del	5/17/2011	E. Webb
Apr 2011 3rd Di	5/5/2011	General Comment		Mike Sisteck, CI	There needs to be		There will be training offered to	6/3/2011	E. Webb
Apr 2011 3rd Di	5/5/2011	General Comment		Mike Sisteck, CI	Will DNREC develc		Watershed plans would be devi	6/3/2011	E. Webb
Apr 2011 3rd Di	5/5/2011	General Comment		Mike Sisteck, CI	Would the City hav		Technical document will specifi	5/17/2011	E. Webb
Apr 2011 3rd Di	5/5/2011	General Comment		Mike Sisteck, CI	It was discussed at		DNREC will discuss this option v	6/3/2011	R. Greer
Apr 2011 3rd Di	5/6/2011	Section 1 General Provisions	1.3.2.2	Jared Adkins, K	Plans approved pri		This section has been updated t	5/17/2011	E. Webb
Apr 2011 3rd Di	5/6/2011	Section 2 Definitions	Final Stabilizat	Jared Adkins, K	"Final Stabilization		The definition of final stabilizat	5/17/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 1	Article 1.02, p.	Jessica Watson	General permit cov		This section has been revised to	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 1	Article 1.02, p.	Jessica Watson	Land development		TMDLs vary by watershed, but a	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 1	Article 1.03, p.	Jessica Watson	"Furthermore, wh		Class V injection wells require i	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 1	Article 1.03, p.	Jessica Watson	"When a new cons		Dept is developing an MOA with	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.01, p.	Jessica Watson	"However, if the D		No county code gives DNREC au	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.01	Jessica Watson	"The Department r		Tech Doc 2.01 has been amende	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	Article 4.01	Jessica Watson	"A Responsible Pe		We have added daily oversight	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	Article 4.01	Jessica Watson	"If weekly site rev		The wording of this section has	6/3/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.02, p.	Jessica Watson	Recommend modi		Addressed in Checklist on new i	5/13/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.02, p.	Jessica Watson	"In the absence of		DNREC can pursue enforcement	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.02, p.	Jessica Watson	"Every project app		At this time the dates are specu	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.02, p.	Jessica Watson	"Expiring Plans cor		DNREC will develop an "interim	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	Article 2.02, p.	Jessica Watson	"Plans that have b		Reg language change to allow e	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 2	2.05 Professor	Jessica Watson	"When a design co		Wording of the professional jud	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	4.01 Site Const	Jessica Watson	" Once the delegat		Technical Document 4.01 has be	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	4.02 Enforcement	Jessica Watson	Compared to the o		The Technical Document is inter	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	4.03 Contractor	Jessica Watson	"The Blue Card Hol		Tech Doc 4.03 is revised to remc	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 4	4.04 CCR, 2nd p	Jessica Watson	I think the delegat		Sites 20 acres and greater have i	5/27/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 5	5.01	Jessica Watson	Minimum Mainten		We ensure compliance with au	5/26/2011	E. Webb
Technical Docu	5/6/2011	Technical Document Article 5	5.01	Jessica Watson	Std Guidelines for		Guidelines for O&M for BMPs w	5/26/2011	E. Webb
Apr 2011 3rd Di	5/12/2011	Section 1 General Provisions	1.4	Mary Neutz, CI	The City interprets		Depending on permit condition	6/3/2011	E. Webb
Apr 2011 3rd Di	5/12/2011	Section 1 General Provisions	1.7.1	Mary Neutz, CI	The City would like		Delegated Agencies would need	6/3/2011	R. Greer
Apr 2011 3rd Di	5/12/2011	Section 3 Plan Approval Procedures	3.5.1	Mary Neutz, CI	The City is request		30 days will remain in the regul.	5/17/2011	E. Webb
Apr 2011 3rd Di	5/12/2011	Section 3 Plan Approval Procedures	3.8.4	Mary Neutz, CI	Since projects can		Comment addressed in reg lang	5/17/2011	E. Webb
Apr 2011 3rd Di	5/12/2011	Section 5 Post-Const SWM	5.1.4	Mary Neutz, CI	The city interpret t		To date, EPA has generally cons	6/3/2011	E. Webb
Apr 2011 3rd Di	5/12/2011	Section 5 Post-Const SWM	5.6.3.2	Mary Neutz, CI	Due to the new me		S.1.4 has been modified to inclu	6/3/2011	R. Greer
Technical Docu	5/12/2011	Technical Document Article 2	2.01 Delegated	Mary Neutz, CI	Section 2.01 Deleg		This process is set up in absence	5/13/2011	E. Webb
Apr 2011 3rd Di	5/10/2011	Section 1 General Provisions	1.4.2	Doug Hokuf, NI	Suggest clarifying f		A start date will not be added. I	5/16/2011	E. Webb
Apr 2011 3rd Di	5/10/2011	Section 2 Definitions	Adverse Impac	Doug Hokuf, NI	"threatened public		In a situation where there is a c	5/16/2011	E. Webb
Apr 2011 3rd Di	5/10/2011	Section 2 Definitions	Notice of Com	Doug Hokuf, NI	Suggest eliminatin		"permanent" has been remove	5/17/2011	E. Webb

Prior to Public Hearing

- 700+ comments received and considered
- Tracked in a database
- Responses provided

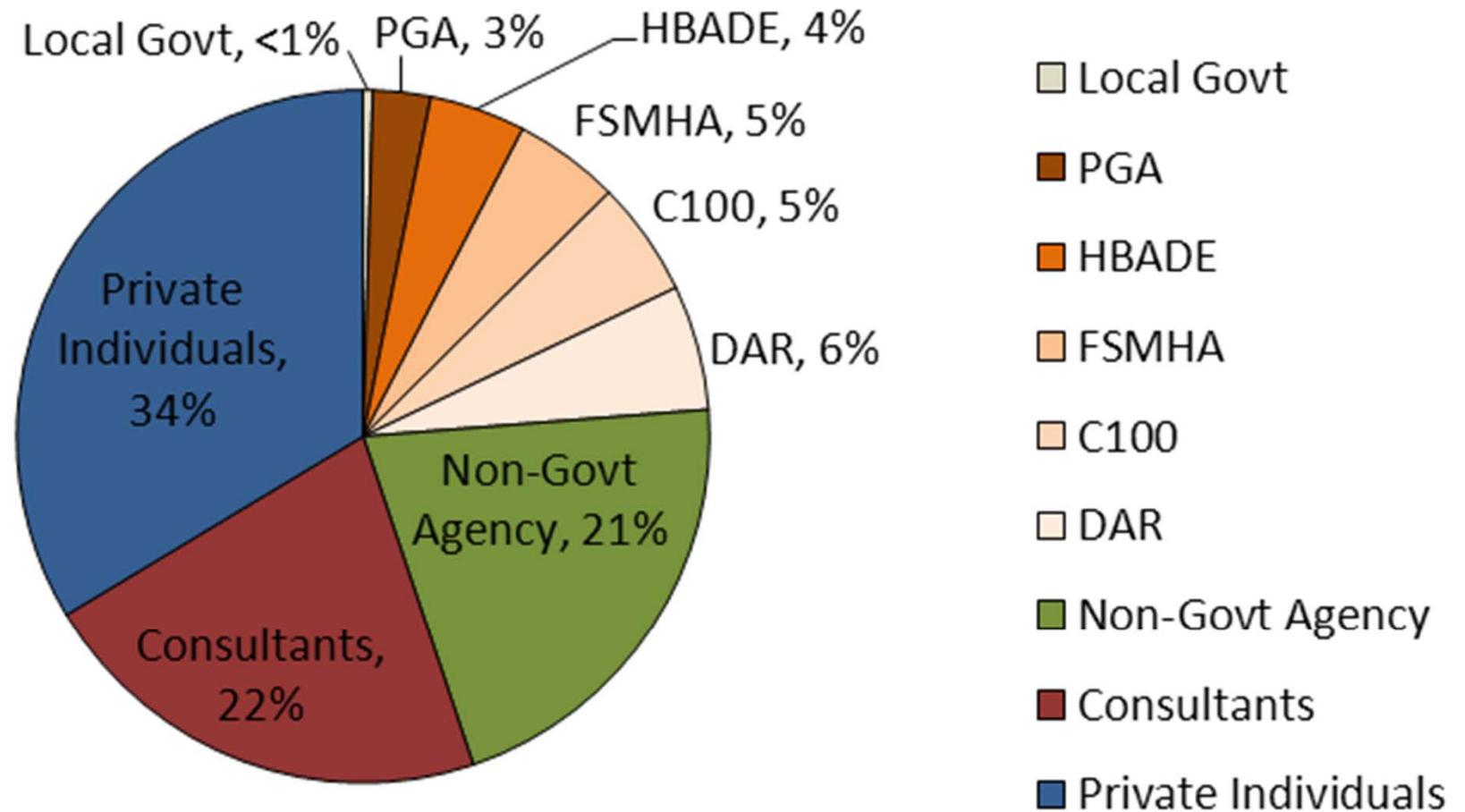
Comments Received as of January 2012

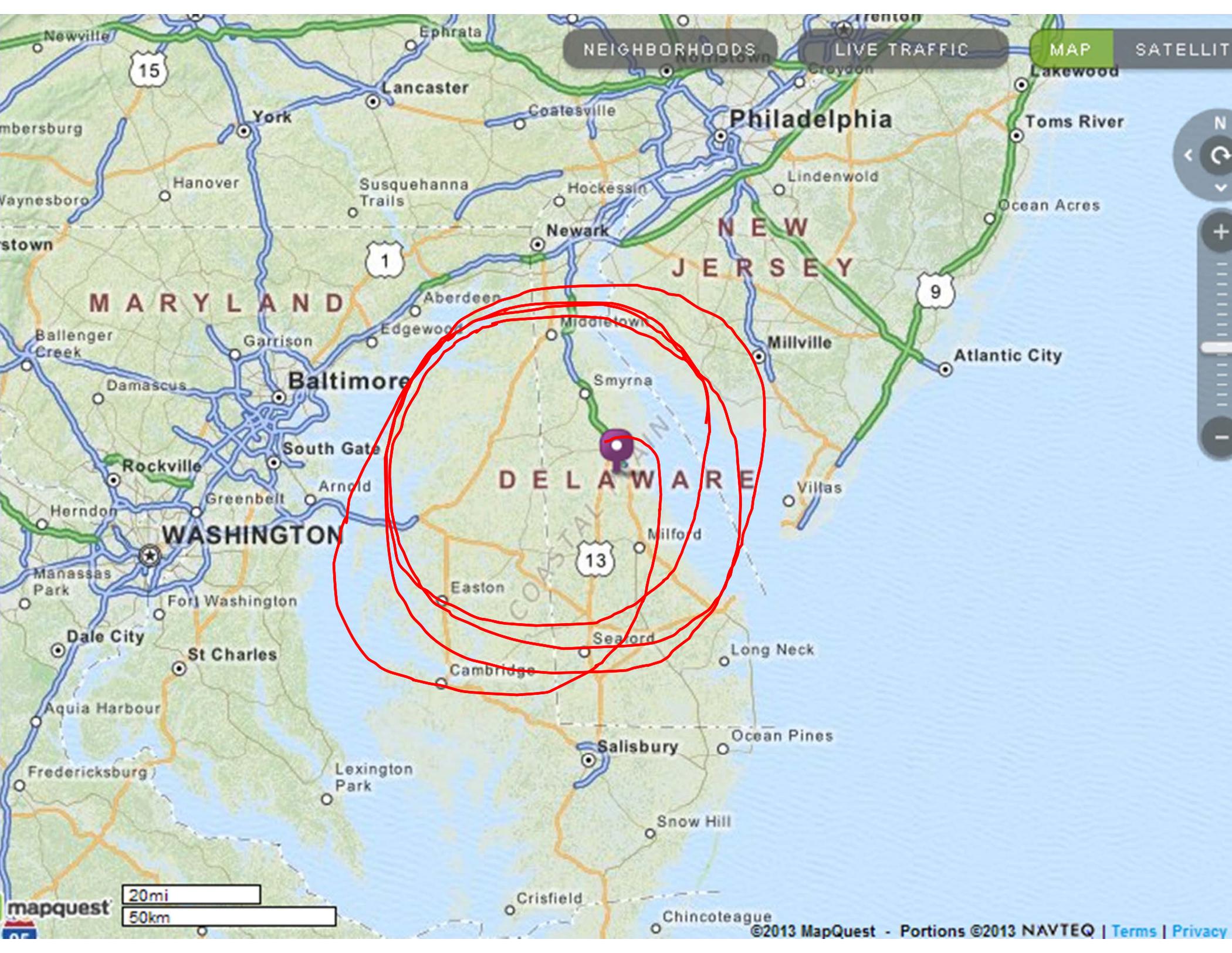


Post Public Hearing

- 200+ comments on Regulations
 - Written comments
 - Presented at Public Hearing
 - Responses provided

Public Hearing Comments





NEIGHBORHOODS

LIVE TRAFFIC

MAP

SATELLIT

Philadelphia

NEW JERSEY

MARYLAND

DELAWARE

WASHINGTON

Baltimore

mapquest 20mi 50km

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Changes to Reg Language

- 1.3 Applicability
- 3.5 Review Procedures
- 5.6 Redevelopment Criteria

1.3 Applicability

- Effective Date
 - 90-day delay for effective date removed
 - Effective date established by Secretary's order
 - Expected to be January 1, 2014

Plan Approval Sunset

- Construction commences
 - Approved plan can be extended in 3-yr approval periods
- Construction does not commence
 - First 3-yr approval period plus one additional 3-yr approval period 

Plans Approved to Comply with Previous Regulations

(Regulations in Place Prior to Revisions)

Effective Date of
Revised Regulations
January 1, 2014



Construction ongoing



No commencement of construction

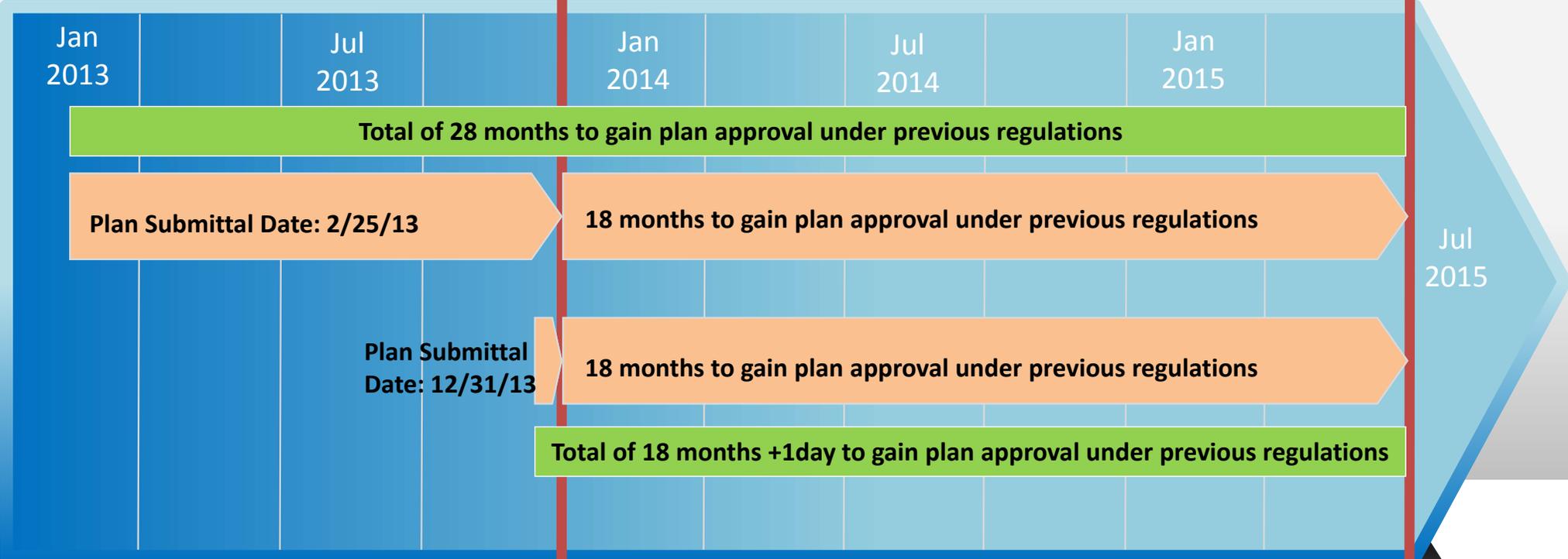
3.5 Review Procedures

- Plans in the review process prior to the effective date
 - Previously 1 year to gain approval
 - Revised to allow 18 months to gain approval under previous regulations

Plans in the Review Process Prior to the Effective Date

Effective Date of
Revised Regulations
January 1, 2014

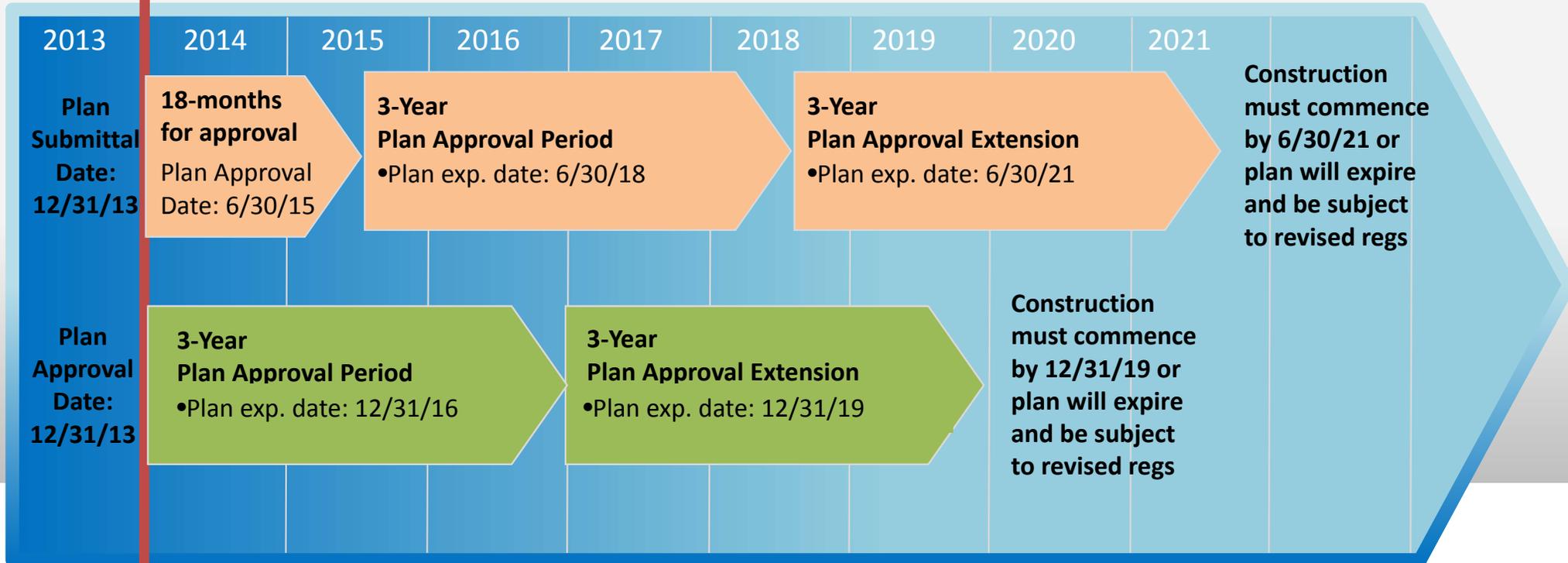
Plan Approval Under
Previous Regulations
July 1, 2015



Extreme Case Scenarios

Start Construction under Previous Requirements

Effective Date of Revised Regulations
January 1, 2014



● 7 years, 6 months to start construction

● 6 years to start construction

Plan Review & Approval Process

- Current Regs
 - 3 Step Process as defined through policy
 - Pre-Application Meeting
 - Sediment & Stormwater Conceptual Plan
 - Sediment & Stormwater Construction Plan
- Proposed Regs
 - 3 Step Process as defined in Regulations
 - Step 1: Project Application Meeting
 - Step 2: Preliminary Sediment & Stormwater Plan
 - Step 3: Sediment & Stormwater Plan

Changes to Plan Review Process

- Reg language
 - 18 months for plans in process
- Tech Doc
 - SAS submittal checklist: removed requirement to have TGD review prior to submittal

5.6 Redevelopment Criteria

- *Section 5.6.3.2: All remaining redeveloped areas within the project limit of disturbance shall employ runoff reduction practices to achieve a 50% reduction in the effective imperviousness based on the **existing condition**.*

5.6 Redevelopment Criteria

- *Section 5.6.3.2: All remaining redeveloped areas within the project limit of disturbance shall employ runoff reduction practices to achieve a ~~50%~~ 30% reduction in the effective imperviousness based on the existing condition.*

Offset Provisions

Department of Natural Resources and Environmental Control
Division of Watershed Stewardship
Sediment and Stormwater Program
7 Del. C. Ch. 40

of a Sediment and Stormwater Management Plan shall pay a fee as prescribed by the Department or Delegated Agency. When the Department is the approval agency, the fees shall not exceed \$80.00 per disturbed acre per project.

1.6.1.2 The establishment of fees, not involving stormwater utilities, shall be in accordance with the following items:

1.6.1.2.1 The number of needed personnel and the direct and indirect expenses associated with those personnel shall be developed by the agencies requesting delegation in a specific jurisdiction in conjunction with and with the concurrence of the Department. Those expenses will then form the basis for determining plan review, construction review and maintenance review costs.

1.6.1.2.2 The fee schedule and revisions to the fee schedule of the Delegated Agency shall be subject to applicable State or local public notice requirements. State public notice requirements shall be governed by 7 Del. C. §6004.

1.6.2 Financial Guarantee

1.6.2.1 The Department or Delegated Agency may require and implement a financial guarantee for construction of the elements of the approved Sediment and Stormwater Management Plan. The Owner shall submit when required to the Department or Delegated Agency a financial guarantee before the onset of construction activities. The financial guarantee will ensure that action can be taken by the Department or Delegated Agency to complete required elements of the approved Sediment and Stormwater Management Plan, at the Owner's expense, should the Owner fail to initiate, complete, or maintain those measures identified in the approved Sediment and Stormwater Management Plan after being given proper notice and within a reasonable time specified by the Department or Delegated Agency.

1.6.2.2 Following approval of the Department, the financial guarantee provisions of the Delegated Agency shall be subject to applicable State or local public notice requirements. State public notice requirements shall be governed by 7 Del. C. §6004.

1.7 Offset Provisions

1.7.1 The Department may require an offset as an alternative to full or partial compliance with the Resource Protection Event requirements as provided in Sections 5.2 and 5.6.3 of these regulations.

1.7.2 Offset requirements shall be subject to Departmental review and approval as well as to the public notice requirements of 7 Del. C. §6004.

1.7.3 Procedures for determining offset requirements shall be developed by the Department and published in the technical document supplement to these regulations.

1.8 These regulations are adopted pursuant to authority conferred by and in accordance with 7 Del. C. Ch. 40 and 7 Del. C. Ch. 60.

1.9 These regulations are not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law. The requirements of these regulations should be considered minimum requirements, and where any provision of these regulations imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.

1.10 If any section, subsection, sentence, clause, phrase or portion of these regulations is for any reason held invalid or unconstitutional by any court or competent jurisdiction, such provision and such holding shall not affect the validity of the remaining portions of these regulations.

1.11 Any person who undertakes or causes to be undertaken any land disturbing activities shall ensure that soil erosion, sedimentation, increased pollutant loads and changed water flow characteristics resulting from these activities are controlled so as to minimize pollution of state waters. The requirements of these regulations are minimum standards and a person's compliance shall not relieve the person from the duty of enacting all measures necessary to minimize pollution of, or detrimental impacts to state waters.

Regulations = WHAT

Technical Document = HOW

Technical Document

- Information supports regulation language
- Public process with regulations
- Future changes will also go through public review process

Technical Document Website

Technical_document - Windows Internet Explorer
http://www.dnrec.delaware.gov/swc/Drainage/Pages/Technical_document.aspx

Delaware.gov | Text Only Governor | General Assembly | Courts | Elected Officials | State Agencies

State of Delaware
The Official Website of the First State

Your Search... SEARCH Phone Numbers Help

DNREC : Division of Watershed Stewardship : Drainage and Stormwater Section

Home

- About Us
- Contact Us/Office Locations
- Newsroom
- FAQ
- Sections/Programs
- DNREC Public Notices

Services

- Conservation Districts
- Contractor Services
- Debris Pit Program
- Environmental Navigator
- Environmental Navigator (Revised - Beta version)
- Loans, Grants, Cost-Share
- Macroalgae Harvesting

Drainage & Stormwater Section

Sediment & Stormwater Technical Document

This series of articles has been assembled as a technical document to support the revisions to the Delaware Sediment and Stormwater Regulations. The articles and appendices contain information, policies, procedures, checklists and examples to assist the regulated community in complying with the sediment and stormwater regulations.

DRAFT - Documents for review only

Article 1. Sediment and Stormwater Program Background

- 1.01 Executive Summary
- 1.02 Federal Clean Water Act Requirements
 - Appx. 1.02.1 Construction General Permit Program Delegation
 - Appx. 1.02.2 NPDES Construction General Permit Guidance
- 1.03 State Responsibilities

Article 2. Policies and Procedures

- 2.01 Delegated Agencies
- 2.02 Plan Policies and Procedures
- 2.03 Fees and Financial Guarantees
- 2.04 Offsets Provisions
 - Appx. 2.04.1 In-Lieu Fee Proposal for On-Site Stormwater Management
 - Appx. 2.04.2 Fee-In-Lieu Example

Technical Document Articles

- **Article 1.** Sediment and Stormwater Program Background
- **Article 2.** Policies and Procedures
- **Article 3.** Plan Review & Approval
- **Article 4.** Construction Review & Compliance
- **Article 5.** Maintenance of Permanent Stormwater Management Systems

Tech Doc Changes

- Article 2
 - Grandfathering
 - Offsets

Offset Provisions

DRAFT Offset Policy January 2013

Background

The Department recognizes that some project sites will have limitations in their ability to comply with the Resource Protection event (RPv) requirements of the *Delaware Sediment and Stormwater Regulations* using traditional stormwater best management practices (BMPs). An offset is an option for compliance with the RPv requirements when those requirements cannot be fully met on the project site. Typically, an offset will be proposed for sites having limitations; however, there may be special circumstances where the Department may consider approval of an offset as a means for compliance for reasons other than site limitations.

Stormwater management offsets can include fees-in-lieu, trading, retrofitting previously unmanaged sites, mitigation, construction of off-site management measures, banking, or other similar techniques when approved by the Department. The technical protocols to determine whether a particular offset is acceptable and a management framework to oversee the process must be provided. While any of the various offset options may be considered for any project site, in order to ensure that at least one offset option has the criteria for implementation defined, the Department has developed a procedure for a fee-in-lieu offset.

Procedures

Plan Review

All projects that require a detailed Sediment and Stormwater Plan approval will follow the three-step submittal process. The first step in the submittal process is the project application meeting. Upon independent completion of the Stormwater Assessment Study (SAS), the owner's representative will schedule a project application meeting with the approval agency. At the project application meeting, the owner and/or owner's representative and the approval agency will discuss methods for complying with the Sediment and Stormwater Regulations on the site, including site design techniques and BMPs to be implemented in order to meet the RPv requirements. The result of the SAS and project application meeting is a Stormwater Assessment Report (SAR), at which time the owner and/or owner's representative will indicate how they may overcome any assessment items rated "Significant" for the site. It is at this awareness step in the process that an owner may begin considering an offset for compliance.

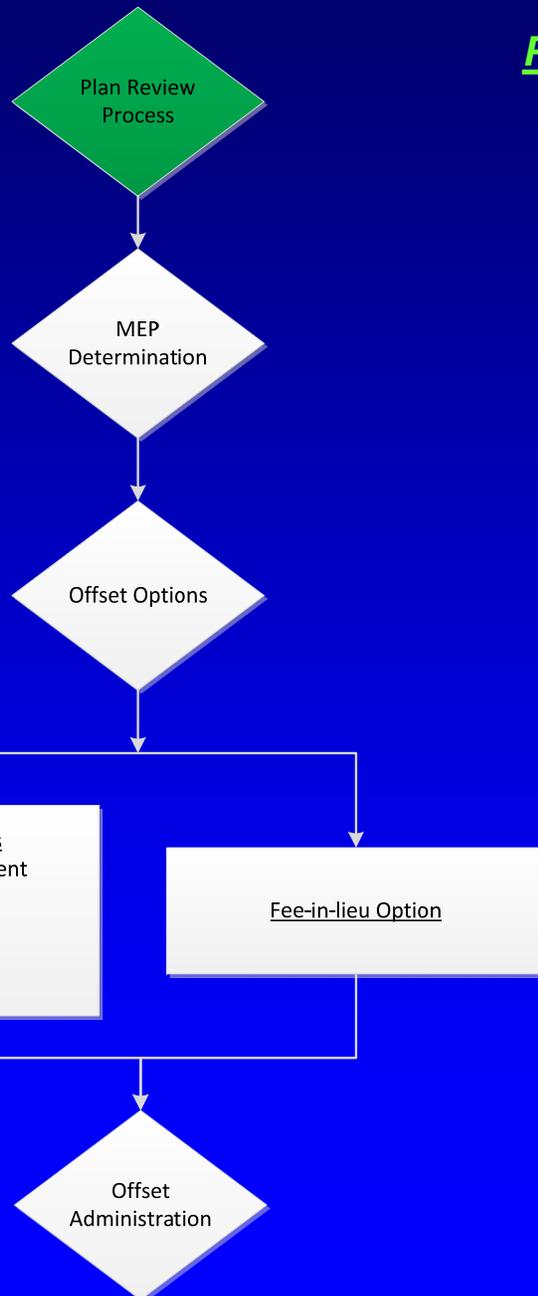
The second step in the plan review and approval process is submittal of the Preliminary Sediment and Stormwater Management Plan. The Preliminary Sediment and Stormwater Plan requirements are fully described in Section 3.3 of the *Regulations* and Technical Document Article 3.02.2. The submittal of the preliminary plan will demonstrate either full compliance with the RPv using onsite BMPs, or the need to consider an offset. The current version of the

Draft Technical Document
Article 2.04 Offsets & Mitigation

Proposed Revisions to Delaware Sediment & Stormwater Regulations: Fee-In-Lieu

- Equivalent to cost to treat runoff volume not managed
- Based on construction and maintenance costs for bioretention
- Analysis was performed by Center for Watershed Protection using regional data
- Fee = **\$23/cu.ft.** runoff volume not managed
 - \$15.15/cu. ft. construction costs
 - \$7.60/cu. ft. O&M costs @ 20-yr present value

Offset Process



Plan Review Process Indicates Site May Qualify for Offset

- Stormwater Assessment Report (SAR) contains multiple “Significant” ratings
- Analysis indicates on-site compliance may be an inferior solution
- Preliminary Sediment & Stormwater Plan (H&H study) indicates on-site compliance costs may exceed Maximum Extent Practicable (MEP)

Offset Process

“MEP”

“Maximum Extent Practicable” means, for the purpose of these Regulations, using stormwater management measures, techniques and methods that are available and capable of being implemented while **taking into consideration cost, available technology, and project site constraints.**

*Ref: Proposed revisions to the Delaware Sediment & Stormwater Regulations
Sect 2.0 Definitions*

Offset Process

“MEP”

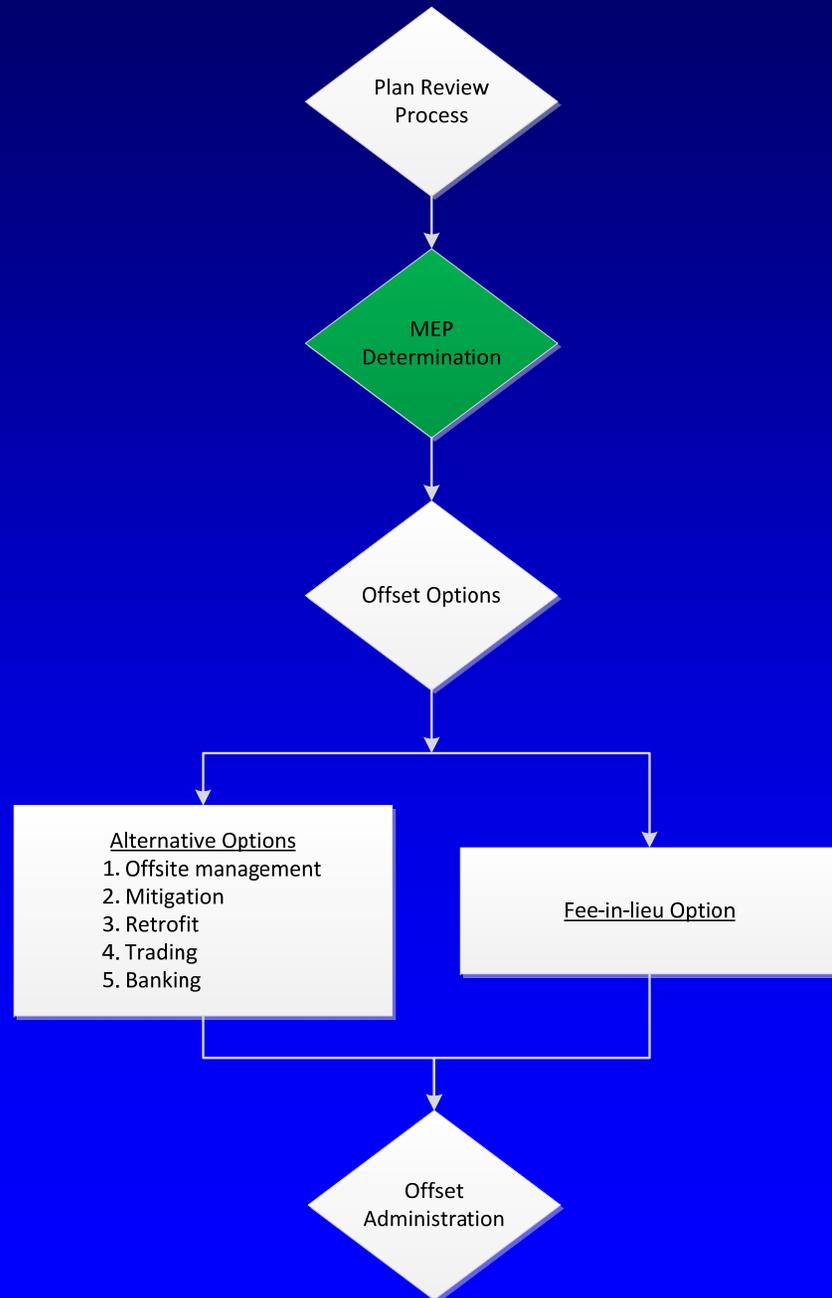
Table 1. Bioretention Construction Costs

Source	Construction Costs ¹ (\$/ft ³)	Basis for Costs	Notes
Weiss (2007)	18.39 ²	Cost formula	Formula based on WQv; Includes present costs of 20-year O&M
City of Raleigh, NC (2010)	15.15 ³	Project costs	Cost/ft ² converted w/ typical section; No long term O&M included
WEG (2010)	14.65 ³	Project costs	Cost/ft ² converted w/ typical section; No long term O&M included
Chavez (2007)	8.86	Project costs	Average costs of 4 urban (paved catchment) installations in OK; total costs, volume, drainage area and surface area provided; No long term O&M included
CWP (2007)	8.35 ⁴	Cost formula	updates Brown and Schueler (1997); No long term O&M included
Brown & Schueler (1997)	7.45 ⁴	Cost Formula	Base Construction costs, No long term O&M included
Wossink & Hunt (2003)	5.45 ²	Cost formula	Clay soils; Includes present costs of 20-year O&M

¹ Costs are provided in units of 2010 dollars per cubic foot of treatment or water quality volume.

*Ref: Fee-In-Lieu Memo (CWP, 2011)
Technical Document Article 2.04.2*

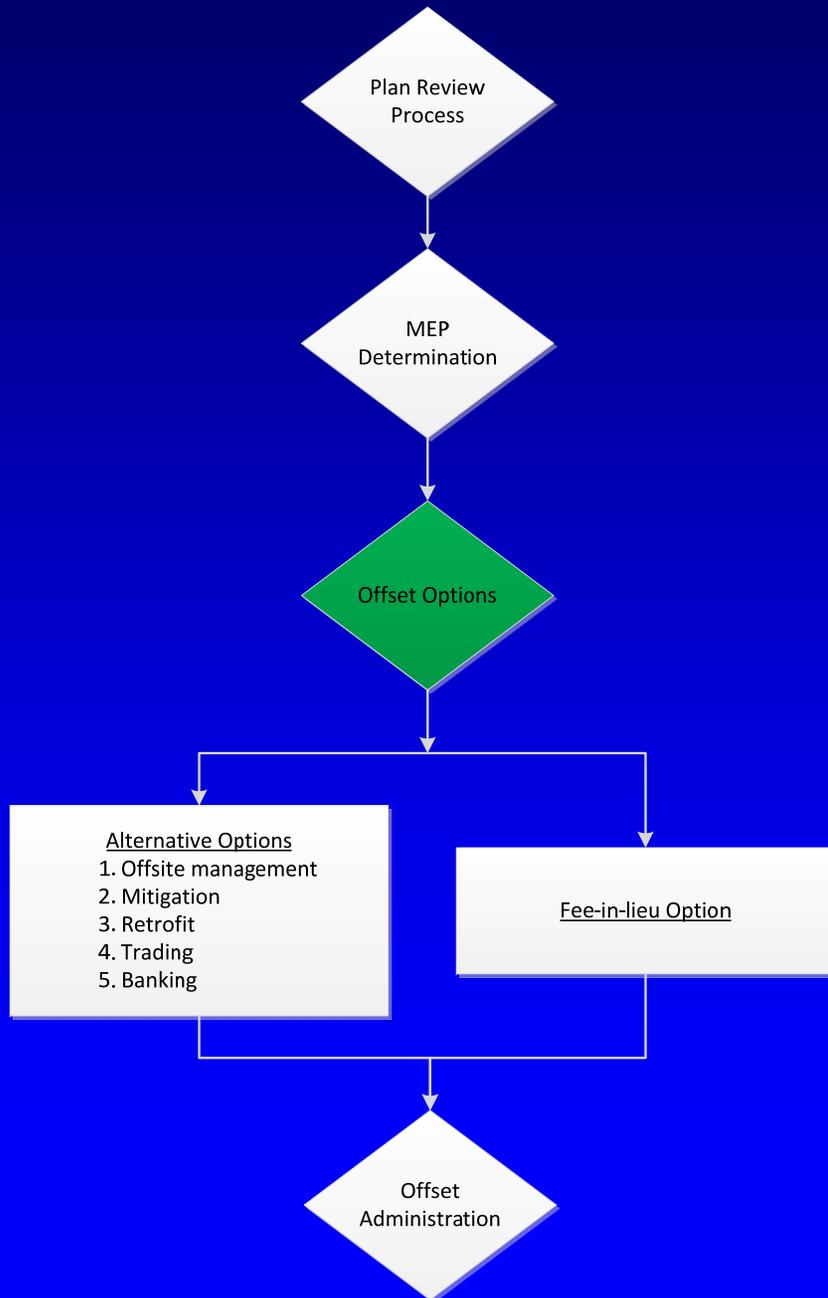
Offset Process



DNREC Proposal for MEP

- MEP defined as estimated construction costs to meet R_{Pv} volume reduction requirements > **\$10/cu. ft.**

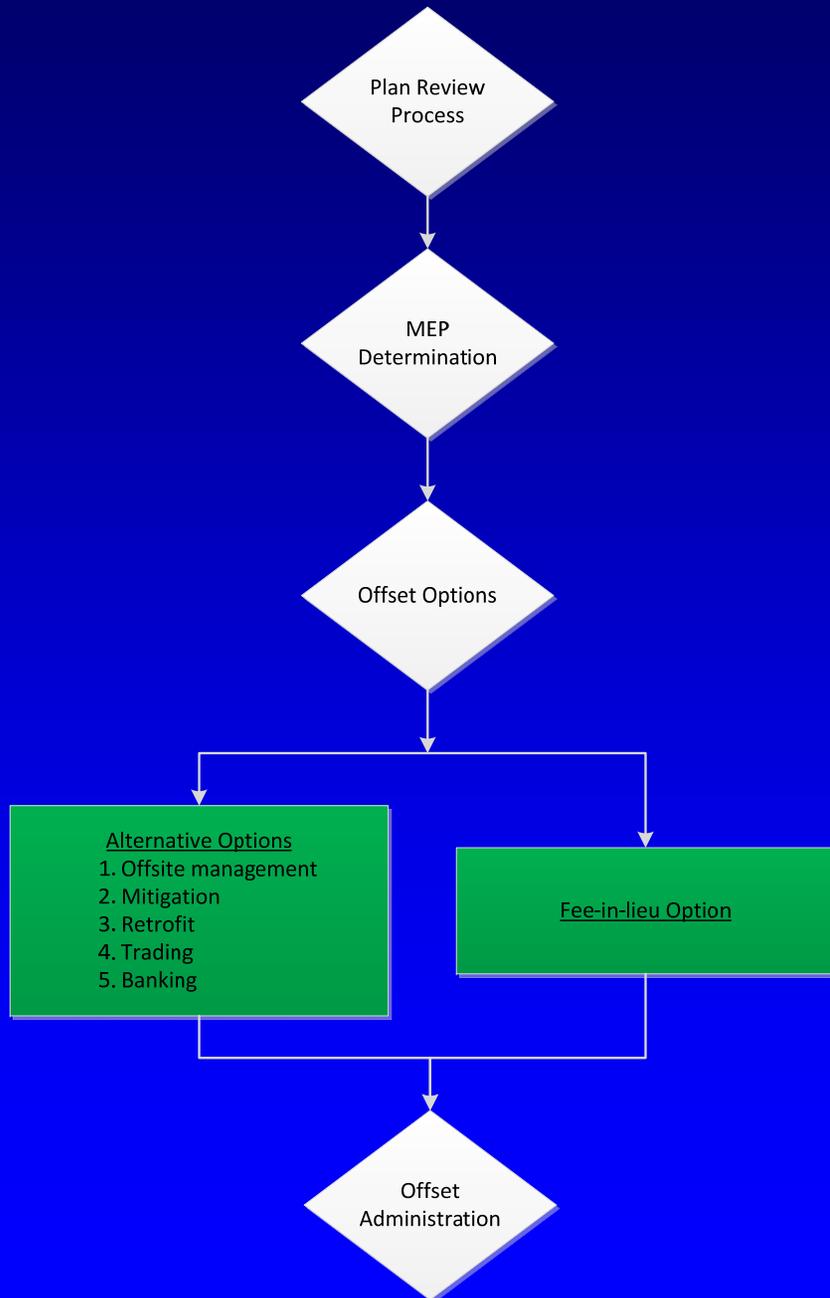
Offset Process



Offset Options

- Applicant proposes offset option

Offset Process



DNREC Proposal for Fee-in-Lieu Option

- Use cu.ft. of runoff as “common currency”
- Alternative practices may be considered using an “exchange rate” with the “common currency”
- Based on **\$18/cu.ft.**
- Collect fee-in-lieu prior to start of construction as default for all offset options and then refund the fee when an alternative option is implemented within a prescribed time frame

Overall Objectives for Fee-In-Lieu

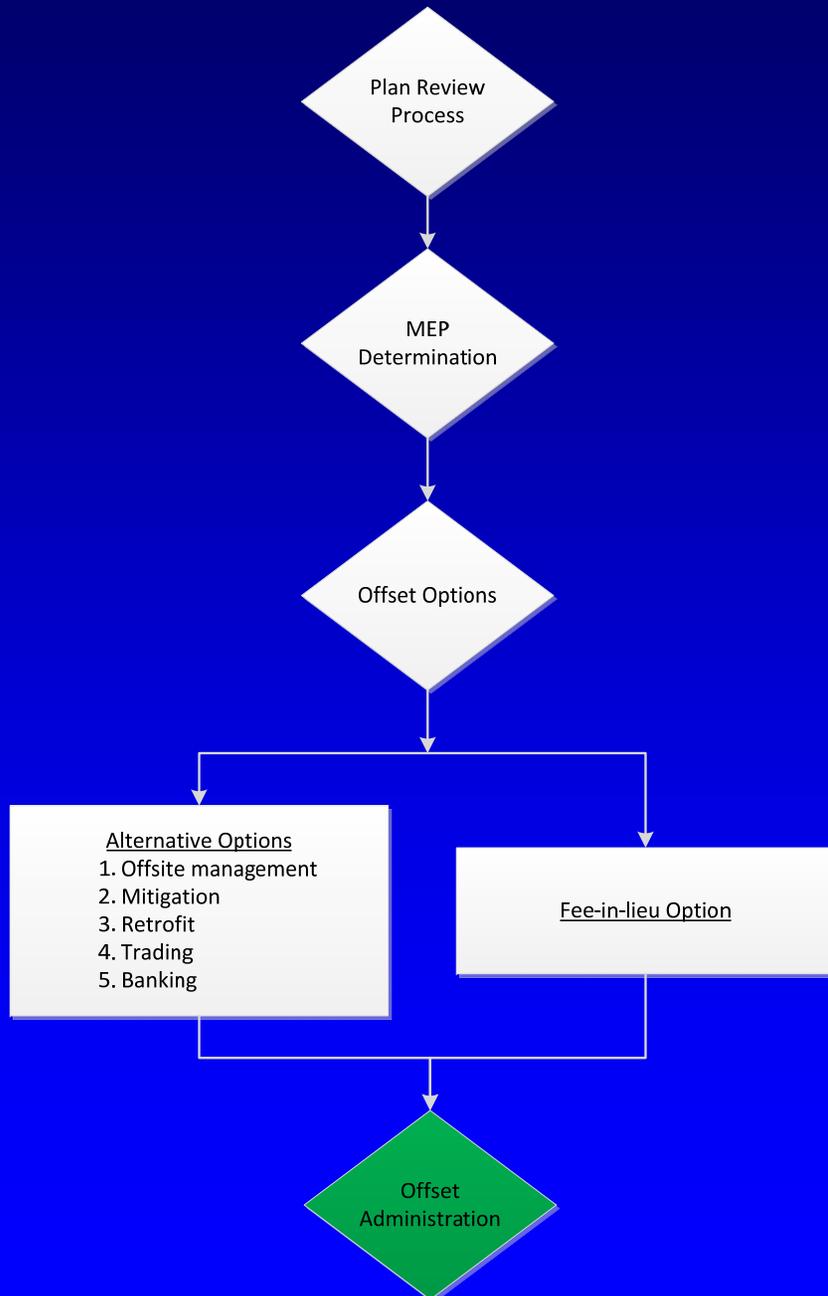
- The offset fees collected will be used to **mitigate the negative impacts** associated with urban stormwater runoff at the watershed level.
- Potential uses should be **prioritized based on their benefits** at the watershed level.

Potential Uses of Fee-In-Lieu



- Implement recommendations of Watershed Management Plans
- Stormwater BMP retrofit projects
- Stream restoration projects
- Regional facilities
- Volume management from other sources
- Others????

Offset Process



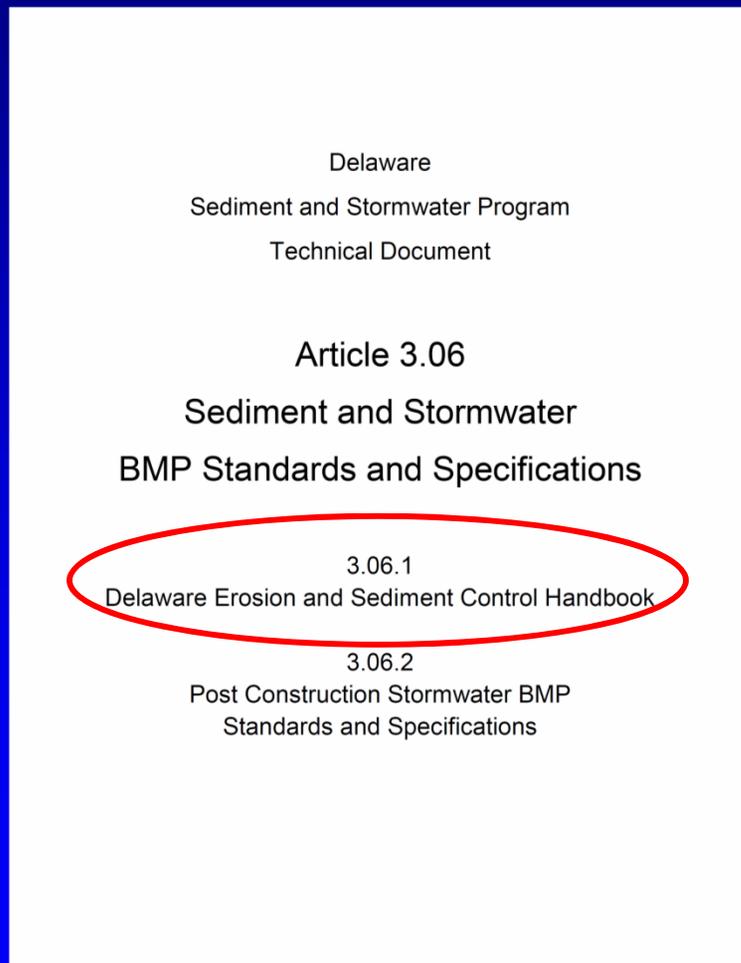
DNREC Proposal for Offset Administration

- Initially DNREC/CWAC function

Tech Doc Changes

- Article 3
 - SAS Checklist
 - Project Application Meeting document
 - Stormwater Assessment Report
 - Preliminary Plan Checklist
 - DURMMv2 & Documentation

Tech Doc Changes



- Rescinded ESC Practices
 - Pipe Dewatering Device
- Revised ESC Practices
 - Culvert Inlet Protection
 - Topsoiling + Compost
 - Mulching w/Compost Blanket
 - Stabilization Matting - BioNetting
 - Sensitive Area Protection
 - Pollution Prevention/Spill Control
- New ESC Practices
 - Compost Log Sediment Trap
 - Type 3 Inlet Protection
 - Compost Log
 - Flocculation
 - Slope Treatment – EC Log
 - Concrete Washout
 - Concrete Mixing Operation
 - Soil Stockpile

Tech Doc Changes

Delaware
Sediment and Stormwater Program
Technical Document

Article 3.06
Sediment and Stormwater
BMP Standards and Specifications

3.06.1
Delaware Erosion and Sediment Control Handbook

3.06.2
Post Construction Stormwater BMP
Standards and Specifications

3.06.2
Post Construction Stormwater BMP Standards and Specifications

Specifications:

- 3.06.2.1 Infiltration
- 3.06.2.2 Bioretention
- 3.06.2.3 Permeable Pavement Systems
- 3.06.2.4 Vegetated Roofs
- 3.06.2.5 Rainwater Harvesting
- 3.06.2.6 Restoration Practices
- 3.06.2.7 Rooftop Disconnection
- 3.06.2.8 Vegetated Channels
- 3.06.2.9 Sheet Flow to Filter Strip or Open Space
- 3.06.2.10 Detention Practices
- 3.06.2.11 Stormwater Filtering Systems
- 3.06.2.12 Constructed Wetlands
- 3.06.2.13 Wet Ponds
- 3.06.2.14 Soil Amendments
- 3.06.2.15 Proprietary Practices
- 3.06.2.16 Source Controls

Appendices:

- 3.06.2. A-1 Soil Investigation Procedures
- 3.06.2. A-2 Landscaping Guidelines
- 3.06.2. A-3 Compost Material Properties
- 3.06.2. A-5 Design of Stormwater Conveyance Systems
- 3.06.2. A-6 Design of Flow Control Structures
- 3.06.2. A-7 Stormwater Hotspots Guidelines

Tech Doc Changes

2.0 Bioretention

Definition: Practices that capture and store stormwater runoff and pass it through a filter bed of engineered soil media comprised of sand, lignin and organic matter. Filtered runoff may be collected and returned to the conveyance system, or allowed to infiltrate into the soil. Design variants include:



- 2-A Traditional Bioretention
- 2-B In-Situ Bioretention (including Rain Gardens)
- 2-C Streetscape Bioretention
- 2-D Engineered Tree Boxes
- 2-E Stormwater Planters
- 2-F Advanced Bioretention Systems

Bioretention systems are typically designed to manage stormwater runoff from frequent, small magnitude storm events, but may provide stormwater detention of larger storms (e.g., 10-yr) in some circumstances. Bioretention practices shall generally be designed such that larger storm events bypass the system into a separate facility where site conditions allow.

For each of the design variants above, there are two basic configurations:

- **Underdrain Designs:** Practices with a positive discharge using perforated pipe; pollutant reduction occurs through a combination of runoff reduction and treatment by the filtering media. Addition of an infiltration sump is required to maximize runoff reduction performance. Advanced systems may provide greater pollutant removal capabilities through the use of improved media components and/or internal modifications that encourage partial anaerobic conditions.
- **Infiltration Designs:** Practices with no underdrains that can infiltrate the design storm volume within 48 hours; pollutant reduction is based solely on the load reduction provided by the design retention storage volume.

The particular design configuration to be implemented on a site is typically dependent on specific site conditions and the characteristics of the underlying soils. These criteria are discussed in more detail below.

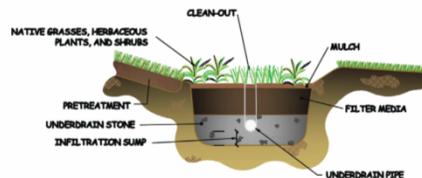


Figure 2.1. Traditional Bioretention Underdrain Design

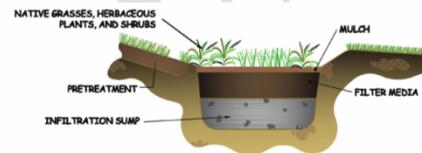


Figure 2.2. Traditional Bioretention Infiltration Design

2.1 Bioretention Stormwater Credit Calculations

The retention volume credit for Bioretention practices depends on the volume of runoff that is infiltrated from this practice (Table 2.1a & b). In addition, Bioretention systems using an underdrain receive a removal efficiency credit for filtering pollutants as they pass through the soil media.

2.1(a) Bioretention With Underdrain Performance Credits

Runoff Reduction	
Retention Allowance	50%
RPv -A/B Soil	50% of Retention Storage
RPv - C/D Soil	50% of Retention Storage
Cv	5% of Retention Storage
Fv	1% of Retention Storage
Pollutant Reduction*	
TN Reduction	100% of Load Reduction + 30% Removal Efficiency
TP Reduction	100% of Load Reduction + 40% Removal Efficiency
TSS Reduction	100% of Load Reduction + 80% Removal Efficiency

*Advanced systems may provide higher removal efficiencies

2.1(b) Bioretention With Infiltration Performance Credits

Runoff Reduction	
Retention Allowance	100%
RPv -A/B Soil	100% of Retention Storage
RPv - C/D Soil	100% of Retention Storage
Cv	100% of Retention Storage
Fv	100% of Retention Storage
Pollutant Reduction	
TN Reduction	100% of Load Reduction
TP Reduction	100% of Load Reduction
TSS Reduction	100% of Load Reduction

Tech Doc Changes

- Article 4
 - New BMP Construction Checklists:
 - Infiltration
 - Bioretention
 - Vegetated Channels
 - Dry Detention
 - Underground Detention
 - Filtering Systems
 - Wet Pond

Tech Doc Changes

- Article 5
 - New Maintenance Review Checklists:
 - Permeable Pavement
 - Vegetated Roofs
 - Rainwater Harvesting
 - Rooftop Disconnection
 - Vegetated Channels
 - Sheet Flow to Open Space
 - Filtering Systems
 - Constructed Wetlands

Timeline

- April 1, 2013: Delaware Register
- April 23, 2013: Public Hearing
- July 2013: Promulgation
- January 2014: Effective Date

Training and Outreach

- Promulgation in July 2013
- Training throughout Fall 2013
 - DURMM v.2
 - Standards & Specifications
- Effective in January 2014

Training and Outreach

- 4 training sessions to start
- Example plans prepared by consultants
- Training offered to Delegated Agencies first
- Circuit Rider Trainer for DURMMv.2
- CBP Partnership Training Grant

Questions???

***"Cities routinely build in the flood plain.
That's not an act of God; that's an act of
City Council."***

-Kamyar Enshayan
College professor & City Councilman
Cedar Falls, Iowa
Following the devastating flooding of the Cedar River in 2008