Green Infrastructure and the Regulatory Framework

Gina Snyder
EPA New England
Water Quality

- Effects of stormwater runoff

The Regulatory Framework

- Requirements
- Definitions
  - Specifics, mapping
- Orders and Integrated Strategies
- BMP Study example
- and, Soak up the Rain
Before and After?

Then and Now
Effects of Runoff

Water Quality and Quantity are Impacted

http://www.stewardship.gatech.edu/runoff.jpg

http://www.cityofchesapeake.net/Assets/images/departments/public_works/PollutioninStormwaterRunoff.jpg
Increased Runoff

Reduced Infiltration

- Natural Ground Cover: 40% evapotranspiration, 10% runoff, 25% shallow infiltration, 25% deep infiltration
- 10%-20% Impervious Surface: 38% evapotranspiration, 20% runoff, 21% shallow infiltration, 21% deep infiltration
- 35%-50% Impervious Surface: 35% evapotranspiration, 30% runoff, 20% shallow infiltration, 15% deep infiltration
- 75%-100% Impervious Surface: 30% evapotranspiration, 55% runoff, 10% shallow infiltration, 5% deep infiltration
Water Quantity Impacts

Increased stormwater volume & velocity
Stream widening & down-cutting
Decreased baseflow
And . . . more flooding!

Changes to Stream Geomorphology
Regulatory Framework

- Clean Water Act, Section 402
- & Title 40 of the Code of Federal Regulations

EPA National Pollutant Discharge Elimination System
NPDES Regulations, 40 CFR 122
DECLARATION OF GOALS AND POLICY

CWA SECTION 101

(a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.

In order to achieve this objective, it is hereby declared that, consistent with the provisions of this Act—

(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;
Regulatory Framework

Clean Water Act, Section 402

EPA NPDES Regulations, 40 CFR 122

National

EPA NPDES Permits
(5 states, most territories and Indian country lands)

State by State

Authorized States

State Laws and Regulations
(45 States and PR)

Unauthorized States

State NPDES Permits

Regulated Universe

Facility and General

Municipal and Industrial
GP: MS4s, Construction Sites, Industrial Facilities
Appurtenances

- Facility or activity means any NPDES ``point source'' or any other facility or activity (including land or appurtenances thereto) that is subject to regulation under the NPDES program.
WATER QUALITY

What is a TMDL?

TMDL  Total Maximum Daily Load

TMDL = \sum WLA + \sum LA + MOS

WLA = Wasteload allocation
LA = Load allocation
MOS = Margin of safety
If the TMDL is not met, the water body impairment must be addressed
POTWs
MS4s
Permits
Orders
and Decrees
PART I

A.1. During the period beginning the effective date and lasting through expiration, the permittee is authorized to discharge from outfall serial number 001, treated effluent to the Connecticut River. Such discharge shall be limited and monitored by the permittee as specified below.

<table>
<thead>
<tr>
<th>EFFLUENT CHARACTERISTIC</th>
<th>EFFLUENT LIMITS</th>
<th>MONITORING REQUIREMENTS</th>
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<tbody>
<tr>
<td></td>
<td>Mass Limits</td>
<td>Concentration Limits</td>
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<tr>
<td></td>
<td>Average Monthly</td>
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<tr>
<td></td>
<td>Maximum Daily</td>
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<td>Maximum Daily</td>
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<tr>
<td></td>
<td>Measurement Frequency</td>
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<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
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</thead>
<tbody>
<tr>
<td>FLOW¹</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>Report MGD</td>
<td>***</td>
<td>Report MGD</td>
<td>CONTINUOUS</td>
<td>RECORDER</td>
</tr>
<tr>
<td>FLOW²</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>Report MGD</td>
<td>***</td>
<td>Report MGD</td>
<td>CONTINUOUS</td>
<td>RECORDER</td>
</tr>
<tr>
<td>BOD³</td>
<td>1051 lbs/Day</td>
<td>1576 lbs/Day</td>
<td>Report</td>
<td>30 mg/l</td>
<td>45 mg/l</td>
<td>Report mg/l</td>
<td>2/WEEK</td>
<td>24-HOUR COMPOSITE⁸</td>
</tr>
<tr>
<td></td>
<td>478 kgs/Day</td>
<td>716 kgs/Day</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>TSS⁵</td>
<td>1051 lbs/Day</td>
<td>1576 lbs/Day</td>
<td>Report</td>
<td>30 mg/l</td>
<td>45 mg/l</td>
<td>Report mg/l</td>
<td>2/WEEK</td>
<td>24-HOUR COMPOSITE⁸</td>
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<tr>
<td>pH RANGE⁶</td>
<td>6.5 - 8.3 SU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/DAY</td>
<td>GRAB</td>
</tr>
<tr>
<td></td>
<td>SEE PERMIT PAGE 4 OF 16, PARAGRAPH 1.A.1.b.</td>
<td></td>
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<tr>
<th>FECAL COLIFORM⁷</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
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<th>Concentration Limits</th>
<th>Measurement Frequency</th>
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<tr>
<td>(April 1 - October 31)</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>200 cfu/100 ml</td>
<td>2/WEEK</td>
<td>GRAB</td>
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<table>
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<tr>
<th>TOTAL RESIDUAL CHLORINE⁸</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Concentration Limits</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>1 mg/l</td>
<td>1/DAY</td>
<td>GRAB</td>
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<table>
<thead>
<tr>
<th>TOTAL KJELDAHL NITROGEN</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Concentration Limits</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>Report mg/l</td>
<td>1/MONTH</td>
<td>24-HOUR COMPOSITE⁸</td>
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</table>

<table>
<thead>
<tr>
<th>NITRITE PLUS NITRATE</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Concentration Limits</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>Report mg/l</td>
<td>1/MONTH</td>
<td>24-HOUR COMPOSITE⁸</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL PHOSPHORUS</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Maximum Daily</th>
<th>Concentration Limits</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>Report mg/l</td>
<td>1/QUARTER</td>
<td>24-HOUR COMPOSITE³</td>
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<table>
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<tr>
<th>WHOLE EFFLUENT TOXICITY¹⁰</th>
<th>Average Monthly</th>
<th>Average Weekly</th>
<th>Concentration Limits</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>Acute LC₅₀ &gt; 50%</td>
<td>2/YEAR</td>
<td>24-HOUR COMPOSITE³</td>
</tr>
</tbody>
</table>
Publicly Owned Treatment Works: Operation and Maintenance of the Sewer System

Each collection system should:

1. Have an accurate map of the collection system
2. Have adequate Maintenance Staff and Funding
3. Maintain a Preventative Maintenance Program
4. Assess Capacity and Condition
5. Plan for the future

EPA NPDES permit language
General Permits

Phase II Coverage

MS4s

Urban areas
Designated non urban communities
Non-traditional MS4s
What’s an MS4?
Availability of Draft General MS4 Permits

Massachusetts
North Coastal Draft
and Interstate, Merrimack, South Coastal Draft

Required Notice of Intent

Info

Basic Info
2003 permit items
Endangered Species
Historic Properties
BMPs
Cert & signature
Stormwater Management Program details the activities to meet permit requirements. Make it available - EPA, MassDEP, FWS, NMFS, and public.
Six Minimum Measures

1. Public education
2. Public involvement
3. Illicit discharge detection & elimination
4. Construction runoff
5. Post-construction stormwater management
6. Pollution Prevention
The regulations, 40 CFR 122.35, allow for MS4s to share responsibility for the implementation of the six minimum measures.
MS4 Maps

Outfalls and receiving waters

Complete system wide map

http://www.flickr.com/photos/kevan/38944425/
Availability of WQ Information

http://www.epa.gov/region1/npdes/stormwater/ma.html
Example:

South Hadley
MA

Waterbody Assessment

TMDL Status
Example:

South Hadley MA
Impervious Cover Map
Orders and Decrees

Examples:

Cleveland
Cincinnati
Louisville
Philadelphia*
Washington DC

Managing Wet Weather with Green Infrastructure

Municipal Handbook

Rainwater Harvesting Policies
Overarching Principles (1 and 2)

- This effort will maintain existing regulatory standards that **protect public health and water quality**.
- This effort will allow a municipality to balance CWA requirements in a manner that addresses the most pressing public health and environmental protection issues first.
Overarching Principles (3 and 4)

- The responsibility to develop an integrated plan rests with the municipality that chooses to pursue this approach. Where a municipality has developed an initial plan, EPA and/or the State will determine appropriate actions...

- Innovative technologies, including green infrastructure, are important tools that can generate many benefits, and may be fundamental aspects of municipalities’ plans for integrated solutions.
* Philadelphia

Triple Bottom Line Study

Green City Clean Waters
Implementation and Adaptive Management Plan

Consent Order & Agreement
Deliverable I

City of Philadelphia Combined Sewer Overflow Long Term Control Plan Update

Submitted to
The Commonwealth of Pennsylvania
StormWater
Maine’s Long Creek Watershed
Years of urbanization: Long Creek no longer complies with state and federal water quality standards—significant impairment due to

- increasing volumes of stormwater runoff and pollutants
- from impervious areas such as parking lots, roadways, and rooftops

www.restorelongcreek.org
Impervious area
Street design
Parking assessment
Green infrastructure

http://www.epa.gov/region1/npdes/stormwater/assets/pdfs/BMPPRetrofit.pdf
The Charles River
Phosphorus Control Plan
an example: a problem and Green Infrastructure in Best Management Practices
Sources of Phosphorus
Stormwater Phosphorus

Mostly associated with very fine particles ~ 40 microns

Washed from impervious surfaces with small amounts of rainfall (0.3 inches)

Stormwater controls must have filtration component to be effective
New England rainfall is approximately 43 inches/year spread over 100 storms, note the large number of small storms contribute substantial flow volume.
Percentage of Total Number of Rainfall Events Based on Size of Rain Events - Boston, MA (1948-2004)

- 0.0 - 0.2 inches: 55%
- 0.2-0.6 inches: 27%
- 0.6-1.0 inches: 10%
- 1.0-1.5 inches: 5%
- 1.5-2.0 inches: 2%
- 2.0 inches and above: 1%
Structural Best Management Practices for Phosphorus Reduction Credit

- Infiltration practices are required when feasible
  - Surface infiltration (e.g., basins, swales, rain gardens)
  - Subsurface infiltration (e.g., trench and chambers)

Excellent for phosphorus and bacteria removal and replenishing ground water aquifers
Example of GIS Map showing Management Categories
Example Structural BMPs
More Structural BMPs
BMP Performance Curve: Infiltration Trench
(Soil infiltration rate 0.52 in/hr)
Summary of Important Points for Managing Stormwater in Developed Watersheds

- Costs will vary greatly depending on approach (current typical approach likely to be more costly than more comprehensive distributed LID approach)
- Effective non-structural BMPs can avoid implementation of the most expensive controls & save considerable costs
- Incorporating small volume surface controls into plan increases feasibility for implementing practices throughout watershed
Treating as much impervious area (IA) as possible could result in:

- Optimal pollutant removal per unit volume treated
- Significant cost savings due to mass implementation of simple low-volume controls (e.g., cisterns, rain gardens, etc.)
- Greater overall water quality benefits (e.g., more IA wash-off receives treatment)
- Greater retention of water within watershed for aquifer recharge, peak flow reduction, and opportunities for reuse
Soak Up the Rain

Be Part of the Solution

Join your neighbors around New England who are taking action to soak up the rain. They're planting trees, rain gardens and green roofs; disconnecting and redirecting their downspouts; using rain barrels and drywells; and replacing their driveways and parking lots with permeable pavement. They're helping to soak up the rain and reduce the polluted runoff that flows to our streams, lakes, rivers and coastlines.

You can help soak up the rain.

Soak up the rain to help:

- Prevent pollution of local waterways
- Reduce flooding
- Protect water resources
- Beautify neighborhoods

EPA New England A-Z Index

Campus RainWorks Challenge
Create a green infrastructure design for your campus
Entries Due December 14, 2012
Learn More

Watch and Learn

- Rhode Island Beaches
- Watch the rubber ducky at Think Blue
- Stormwater Runoff 101
- After the Storm: Chittenden County, Vermont
- EPA Reduce Runoff: Slow it Down, Spread it Out
SOAK UP THE RAIN CAMPAIGN

• to raise awareness and to encourage citizens, businesses and communities to soak up rain water

• **Website:**  [www.epa.gov/region1/soakuptherain/](http://www.epa.gov/region1/soakuptherain/)

• Flickr group where anyone can post pictures of how they’re helping to soak up the rain

• to connect citizens to local organizations, get messages out (e.g. social media *(öffertöff*) ), and share information about what’s happening around New England

• Contact the [Soak Up the Rain web editor](http://www.epa.gov/region1/soakuptherain/)
Questions?

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Thank you