

## **DEVELOPED LAND**

### **BACKGROUND**

According to the 2012 Surface Water Quality Assessment completed by DES, runoff from developed lands (e.g., cities, residential neighborhoods, and other developed areas) contributes to approximately 93% of the water pollution problems in New Hampshire. These pollutants are carried by stormwater and are a major concern for water quality. The Great Bay Nitrogen Nonpoint Source Study (DES, 2014) reports that stormwater delivers 34% of the nitrogen load to Great Bay. Without adequately addressing the existing problems associated with stormwater runoff across the state, additional degradation of the state's water resources is likely.

New Hampshire's population is continuing to grow. The Southern New Hampshire Regional Planning Commission (SNHRPC) estimates that the population in their region, which includes the city of Manchester and 13 surrounding communities, will grow by over 45,000 residents by 2035 (SNHRPC, draft 2014). This increase in growth brings pressure to expand and improve housing, roads, and services, and inevitably increases impervious surfaces that prevent runoff from soaking into the ground.

Not only is New Hampshire's population growing and impervious surfaces increasing, but it is growing faster and growing bigger than in the past. In the Piscataqua Region, for example, the amount of impervious surface covering the land has grown from 28,695 acres in 1990 to 63,241 acres in 2010. On a percentage basis, 9.6% of the land in the watershed was covered by impervious surfaces in 2010. Since 1990, the amount of impervious surfaces in the Piscataqua region increased by 120% while population grew by only 19%. Therefore, the rate of increasing impervious surfaces has been six times the rate of population growth (PREP, 2013). Statewide, land consumption as measured by urbanized acres per capita increased from 0.24 to 0.31, for an increase of 29% during the same 1990- 2010 time period (GSF, 2013).

As New Hampshire communities accommodate this growth, the challenge of climate change impacts compound the problems caused by increased imperviousness. In southern New Hampshire, precipitation has already increased 12 - 20 percent since 1970 and is expected to increase by an additional 15 - 20 percent by 2100. Extreme precipitation events have increased dramatically and are expected to double by 2050. The growing season has lengthened by 2 - 4 weeks on average and may get even longer (Wake, et al., 2014).

Addressing runoff from developed lands requires a mix of regulatory and voluntary programs. At the state level, the Alteration of Terrain (AoT) permitting program specifies procedures and criteria to protect surface water quality by controlling soil erosion, and managing, treating, and recharging stormwater runoff from development activities. In 2013, DES completed an analysis of ten (four new development and six redevelopment) approved AoT projects in impaired watersheds using the Simple Method to compare pre- and post-construction pollutant loading estimates under the permitted conditions and under an alternate condition using enhanced

treatment. Summary observations include:

1. Pollutant loading estimates of new development projects, as permitted, showed an increase in total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). While some new development projects had reductions in TSS as permitted, every new development project had an estimated increase in nutrient loading in the permitted condition. A summary of the estimated % increase in pollutant load and the highest increase at a single site summarized in Table 12.

Table 12. Summary of pollutant loading estimates for new development projects.

PARAMETER	ESTIMATED % INCREASE IN POLLUTANT LOAD	HIGHEST ESTIMATED INCREASE IN LOADING AT SINGLE SITE
Total Suspended Solids (TSS)	26% - 70%	9,400 lbs/year
Total Phosphorus (TP)	22% - 440%	108 lbs/year
Total Nitrogen (TN)	22% - 115%	416 lbs/year

2. Even with enhanced treatment using best management practices with the highest pollutant removal efficiencies, two out of four new development projects resulted in increases in nutrient loading.
3. Redevelopment projects more easily achieved reductions in pollutant loading compared to new development with four of the six re-development projects achieving reductions in TSS, TP, and TN, as permitted. However, substantial additional reductions were estimated for additional treatment and enhanced treatment for redevelopment projects.

It is important to note that pollutant loading models provide relative estimates with varying degrees of accuracy. The results of this modeling exercise serve to inform the discussion on potential ways to strengthen the AoT Program and assure that stormwater from new and redevelopment projects in New Hampshire is managed in a way that is protective of water quality.

While large-scale new and redevelopment projects are permitted at the state level, smaller disturbances such as individual lots and small subdivisions are regulated at the local level. Each municipality has its own set of regulations, procedures, and criteria with regard to development and managing stormwater from developed sites. This lack of uniformity in the regulation of stormwater at the municipal level poses challenges for developers and contractors. In an attempt to increase uniformity, in 2008, DES and the Regional Planning Commissions created the *Innovative Land Use Planning Techniques: A Handbook for Sustainable Development* ([http://des.nh.gov/organization/divisions/water/wmb/repp/innovative\\_land\\_use.htm](http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm)) which includes, among other techniques, a model ordinance for post-construction stormwater management.

Further encouraging regional approaches to local solutions, New Hampshire legislators passed enabling legislation in 2009 to create the Southeast Watershed Alliance (SWA) to provide

a framework for watershed communities to work together to protect and restore its water resources. The SWA encompasses all 42 upstream and downstream communities in the New Hampshire coastal watershed. In 2012, the SWA created the *Model Stormwater Standards for Coastal Watershed Communities* to, again, increase uniformity in managing stormwater in coastal communities.

In 2008 and 2009, the NHDES Watershed Assistance Grants Program provided funding for studies in Manchester, Dover, Portsmouth, and Nashua to determine the feasibility of stormwater utilities as a funding source for their municipal stormwater programs. Funding for these studies was from Clean Water Act Section 319 funds from the USEPA. Feasibility studies help a municipality determine if pursuing a stormwater utility approach to funding is appropriate. The results of the studies and the experiences of the participants were documented throughout the process and are available at <http://des.nh.gov/organization/divisions/water/stormwater/utilities-feasibility.htm>. Despite the passage of stormwater utility enabling legislation and the completed feasibility studies, no stormwater utilities have been formed in New Hampshire. Moving forward, it will be important to assess how changing precipitation patterns are causing additional stress on stormwater infrastructure. It will also be important to understand the capital and operating costs associated with the current funding approaches versus a stormwater utility approach for funding stormwater programs under increased rainfall scenarios.

Municipalities are under increasing pressure to address water quality problems caused by stormwater, primarily through Municipal Separate Storm Sewer (MS4) permits administered by EPA under the National Pollutant Discharge Elimination Program. While specific activities required by MS4 permits are outside the scope of Section 319 funds, regulatory pressure may eventually drive stormwater utility development in New Hampshire, as it has where EPA's use of Residual Designation Authority under the MS4 program resulted in stormwater utilities in cities and towns in Maine, Massachusetts, and Vermont. Stormwater utilities could provide resources to address the significant stormwater infrastructure needs documented in the Clean

Watershed Needs Survey. This survey, completed in 2012, estimated the cost of managing effective municipal stormwater programs in New Hampshire to be over \$386 million (DES, 2012b).

The documented needs occur both in regulated MS4 areas and outside of MS4 areas. To assist municipalities with meeting the costs to manage effective stormwater programs, the passage of RSA 149-I in 2008 enabled municipalities to create municipal stormwater utilities.

In 2012, the DES Watershed Assistance Section initiated a new program called Soak Up the Rain New Hampshire (SOAK) to protect and restore clean water in local lakes, streams, and estuaries from the negative impacts of excess runoff and pollution from stormwater. The program is based



on the 2011 DES publication, *New Hampshire Homeowner's Guide to Stormwater Management Do-it-Yourself Stormwater Solutions for Your Home* (<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf>).

The goal of this voluntary program is to reduce stormwater runoff and associated pollution from residential and small commercial properties through a coordinated, outreach and local capacity building campaign. The 2013 field season piloted the SOAK program by working with three partner organizations, the Great Bay Stewards in the Great Bay Watershed, the Nashua Regional Planning Commission in the Baboosic Lake Watershed, and the Lakes Region Planning Commission in the Lake Waukegan Watershed. In 2014, the Silver Lake Land Trust in Harrisville and the Green Mountain Conservation Group in the Ossipee region joined the program.

The Soak Up the Rain NH Program includes resources, training materials, and technical assistance to local organizations in order to build local SOAK programs. An accompanying website, [www.soaknh.org](http://www.soaknh.org), houses these resources and is used to showcase completed installation projects. The site tracks pollutant removal estimates associated with the installations in order to quantify the water quality benefit of the program over the long-term. Program resources on the website are intended to be used to raise community awareness of the connection between land use and water quality, the potential impacts of residential properties on local water resources, and the shared responsibility for clean water.

## **MEASURES TO CONTROL NPS POLLUTION**

### REGULATORY PROGRAMS

- New Hampshire Alteration of Terrain Permit Program (RSA 485-A:17, Env-Wq 1500)
- EPA National Pollutant Discharge Elimination System Programs
- Municipal Zoning Ordinances, site plan and subdivision regulations

### VOLUNTARY PROGRAMS

- Soak up the Rain New Hampshire
- Local Youth and Lake Conservation Corp Programs (Acton Wakefield Watersheds Alliance, New Hampshire Lakes Association)
- Proactive Municipal Projects

### GUIDANCE DOCUMENTS

- *New Hampshire Stormwater Manual. Volume 1 Stormwater and Antidegradation (WD-08-20A), Volume 2 Post Construction Best Management Practices Selection and Design (WD-08-20B), Volume 3 Erosion and Sediment Control During Construction (WD-08-20C)*. New Hampshire Department of Environmental Services. 2008. <http://des.nh.gov/organization/divisions/water/stormwater/manual.htm>
- New Hampshire Homeowner's Guide to Stormwater Management Do-it-Yourself Stormwater

Solutions for Your Home (WD-11-11). New Hampshire Department of Environmental Services. 2011.<http://des.nh.gov/organization/divisions/water/stormwater/stormwater-mgmt-homeowners.htm>

- Innovative Land Use Planning Techniques: A Handbook for Sustainable Development (WD-08-19). Section 2.1 Permanent (Post-Construction) Stormwater Management. New Hampshire Department of Environmental Services, New Hampshire Association of Regional Planning Commissions, New Hampshire Office of Energy and Planning and New Hampshire Municipal Association. 2008.  
[http://des.nh.gov/organization/divisions/water/wmb/repp/innovative\\_land\\_use.htm](http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm)
- Model Stormwater Standards for Coastal Watershed Communities. Southeast Watershed Alliance. 2012.[http://southeastwatershedalliance.org/wordpress/wp-content/uploads/2013/05/Final\\_SWA\\_SWStandards\\_Dec\\_20121.pdf](http://southeastwatershedalliance.org/wordpress/wp-content/uploads/2013/05/Final_SWA_SWStandards_Dec_20121.pdf)

**TABLE 12. DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Developed Land (DL) Goal. Runoff from developed lands is managed in such a way that water quality is not degraded.							
Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<b>Objective DL-1</b> NPS Program partners understand the costs associated with managing stormwater from developed lands.	<b>Milestone DL-1.1</b> Federal, state, and local decision-makers understand New Hampshire’s stormwater capital needs and associated costs. <i>Partners: DES, Cities of Dover, Manchester, Nashua, and Portsmouth, NH Municipal Association members, NH Stormwater Coalitions</i>	<b>Measure DL-1.1</b> Submit 2016 Clean Watershed Needs Survey to Congress, state, and local decision makers to quantify municipal stormwater capital needs and associated costs.					
	<b>Milestone DL-1.2</b> The need for sustainable funding of equitable stormwater programs is understood and supported. <i>Partners: DES, Legislators, municipalities, Southeast Watershed Alliance, NH Municipal Association, NH Stormwater Coalitions</i>	<b>Measure DL-1.2</b> Provide one presentation every odd year on the completed stormwater utility feasibility study projects and EPA’s <i>Evaluation of the Role of Public Outreach and Stakeholder Engagement in Funding Decisions in New England</i> to gain better public and political understanding and support.					
<b>Objective DL-2</b> NPS Program partners have access to an array of funding opportunities to implement stormwater-related projects.	<b>Milestone DL-2.1</b> The 604(b) Planning Grants are used for NPS and stormwater-related planning projects. <i>Partners: DES, Regional Planning Commissions</i>	<b>Measure DL-2.1</b> Three 604(b) grants are awarded to NPS and stormwater-related planning projects every other year.					
	<b>Milestone DL-2.2</b> Municipalities pursue the development of individual or regional stormwater utilities in New Hampshire to provide adequate, diverse, and sustainable funding of equitable stormwater programs. <i>Partners: DES, legislators, municipalities, Southeast Watershed Alliance NH Municipal Association, NH Stormwater Coalitions</i>	<b>Measure DL-2.2a</b> A list of recommended changes with proposed amendments to RSA 149:I is developed, and changes are adopted to reduce ambiguity and make other improvements that would more fully support the adoption of municipal, regional, or other stormwater utilities in New Hampshire.					
		<b>Measure DL-2.2b</b> Provide assistance to municipalities to complete four new stormwater utility feasibility studies					
		<b>Measure DL-2.2c</b> Provide assistance to the Southeast Watershed Alliance to promote stormwater utility development.					

**TABLE 12 (CONT). DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<b>Objective DL-2</b> (cont.)	<b>Milestone DL-2.3</b> The State Revolving Fund (SRF) Loan is used to fund NPS and stormwater projects in New Hampshire. <i>Partners: DES State Revolving Fund Loan Program, NH Municipal Association members, NH Stormwater Coalitions</i>	<b>Measure DL-2.3a</b> Report on identified barriers and incentives to SRF funding of NPS and stormwater projects.					
		<b>Measure DL-2.3b</b> Completed plan on how to overcome barriers and implement incentives for SRF funding of NPS and stormwater projects.					
		<b>Measure DL-2.3c</b> Annual presentations made to NH Stormwater Coalitions and other municipalities to promote low impact development (LID) projects for SRF applications.					
		<b>Measure DL-2.3d</b> Priority NPS and stormwater SRF projects are awarded loans to meet the annual stormwater allocation.					
<b>Objective DL-3</b> State and local regulatory programs are more fully protective of water quality and minimize the water quality impacts from developed lands.	<b>Milestone DL-3.1</b> Determine whether changes are needed to the Alteration of Terrain (AoT) Rules (Env-Wq 1500) for the 2017 rules re-adoption to improve water quality protection and climate change preparedness through AoT permits. <i>Partners: DES Alteration of Terrain Program and stakeholders, NH Chapter of American Council of Engineering Companies, UNH Stormwater Center</i>	<b>Measure DL-3.1</b> Determination of need for AoT rules containing NPS recommendations, including whether the 1-hour or 10-hour storms should be addressed in design criteria to prevent erosion from more intense, shorter duration storm events.					
		<b>Milestone DL-3.2</b> Work with the AoT Program to draft Re-Development Rules using the Southeast Watershed Alliance’s 3-phase criteria as a model. <i>Partners: DES Alteration of Terrain Program, Southeast Watershed Alliance</i>	<b>Measure DL-3.2</b> Completed AoT Re-Development Rules.				

**TABLE 12 (CONT). DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<b>Objective DL-3</b> (cont.)	<b>Milestone DL-3.3</b> Update Section 2.1 Permanent (Post-Construction) Stormwater Management in the Innovative Land Use Planning Techniques Handbook for Sustainable Development. <i>Partners: Regional Planning Commissions, Alteration of Terrain Program, UNH Stormwater Center, Southeast Watershed Alliance.</i>	<b>Measure DL-3.3</b> Updated Section 2.1 published					
	<b>Milestone DL-3.4</b> Research and draft incentive programs to improve stormwater management on existing developed lands, whether or not there is active re-development. <i>Partners: DES Alteration of Terrain Program, NH Municipal Association members, NH Stormwater Coalitions, NH Home Builders and Remodelers Association, NH Chapter of American Council of Engineering Companies</i>	<b>Measure DL-3.4</b> Incentive program proposal.					
	<b>Milestone DL-3.5</b> Research and determine the feasibility of developing an accounting system (similar to the NHDES Aquatic Resource Mitigation (ARM) Fund or Infrastructure Bank) to allow for water quality trading and offsets in the AoT Program and in the implementation of Total Maximum Daily Load Studies (TMDLs). <i>Partners: DES Alteration of Terrain Program, DES Aquatic Resource Mitigation Program, TMDL Program</i>	<b>Measure DL-3.5</b> Feasibility analysis completed.					

**TABLE 12 (CONT). DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<p><b>Objective DL-4</b> Professional engineers, state and local regulators, and regulated entities have an improved understanding of how stormwater best management practices (BMPs) function and perform over the long term.</p>	<p><b>Milestone DL-4.1</b> Research and determine the appropriateness of using continuous simulation precipitation modeling, as opposed to event-based modeling, to design stormwater practices. <i>Partners: DES Alteration of Terrain Program, NH Municipal Association members, NH Chapter of American Council of Engineering Companies, UNH Stormwater Center</i></p>	<p><b>Measure DL-4.1</b> Decision made.</p>					
	<p><b>Milestone DL-4.2</b> Promote the integration of gray (conventional) and green (low impact development) infrastructure to most effectively achieve both flood control and water quality needs. <i>Partners: DES Alteration of Terrain Program, NH Municipal Association members, NH Chapter of American Council of Engineering Companies, UNH Stormwater Center</i></p>	<p><b>Measure DL-4.2</b> Updated DES Fact Sheets, guidance documents, and other publications, as needed.</p>					
	<p><b>Milestone DL-4.3</b> Update the <i>New Hampshire Stormwater Manual</i>, Volumes 1 - 3 to reflect the new science and understanding of stormwater management, system design, installation, and maintenance, as well as regulatory changes. <i>Partners: DES Alteration of Terrain Program</i></p>	<p><b>Measure DL-4.3</b> Updated <i>New Hampshire Stormwater Manual</i>, Volumes 1 - 3 published</p>					
<p><b>Objective DL-5</b> Stormwater best management practices are adequately maintained and continue to function through their intended design life.</p>	<p><b>Milestone DL-5.1</b> Request and review maintenance records from completed AoT permitted projects to determine effectiveness of a general adherence to maintenance conditions. <i>Partners: DES Alteration of Terrain Program</i></p>	<p><b>Measure DL-5.1</b> Compilation of a subset of maintenance records and summary report of findings each year.</p>					

**TABLE 12 (CONT). DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<b>Objective DL-5</b> (cont.)	<p><b>Milestone DL-5.2</b> Survey municipalities to determine if they currently require that maintenance records be kept for locally permitted projects. Encourage municipalities to request maintenance records for completed, locally permitted projects to determine compliance with maintenance conditions.</p> <p><i>Partners: DES Alteration of Terrain Program, NH Municipal Association members, NH Chapter of American Council of Engineering Companies, UNH Stormwater Center</i></p>	<p><b>Measure DL-5.2</b> List of municipalities that require maintenance records. Completed maintenance inspection/reporting recommendations for municipalities.</p>					
	<p><b>Milestone DL-5.3</b> Promote research, design, and use of low and easy maintenance low impact development practices.</p> <p><i>Partners: DES Alteration of Terrain Program, UNH Stormwater Center</i></p>	<p><b>Measure DL-5.3</b> Promotional messaging included in updated fact sheets and guidance documents.</p>					
	<p><b>Milestone DL-5.4</b> Provide hands on training and technical assistance to municipal public works staff and professional landscapers on the installation and maintenance of low impact development stormwater practices.</p> <p><i>Partners: NH Municipal Association members, UNH Stormwater Center, NH Stormwater Coalitions, NH Landscape Association, UNH Cooperative Extension, NH Sea Grant</i></p>	<p><b>Measure DL-5.4</b> One training per year.</p>					

**TABLE 12 (CONT). DEVELOPED LAND GOALS, OBJECTIVES, AND MILESTONES**

Objective	Milestone	Measure of Success	Schedule				
			2015	2016	2017	2018	2019
<b>Objective DL-6</b> New Hampshire residents understand the connection between land use and water quality, and have access to resources to help manage stormwater on their properties.	<b>Milestone DL-6.1</b> Provide resources to local organizations interested in participating in Soak Up the Rain New Hampshire (SOAK) <i>Partners: DES</i>	<b>Measure DL-6.1</b> SOAK resources are updated and made available through a variety of print and social media.					
	<b>Milestone DL-6.2</b> Recruit, train, and provide assistance to local organizations to participate in SOAK. <i>Partners: DES, SOAK program-eligible organizations</i>	<b>Measure DL-6.2</b> One new local SOAK group per year.					
	<b>Milestone DL-6.3</b> Site level best management practices are installed through the Soak Up the Rain NH program. <i>Partners: DES, SOAK program-eligible organizations</i>	<b>Measure DL-6.3</b> Five BMP installations completed each year. Installation information including location and pollutant loading estimates are reported on the SOAK website and in the NPS Annual Report.					