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Municipal Stormwater Management in Northern New England: A Comparative Study of Leading Programs

Doug Roncarati
University of Southern Maine, Muskie School of Public Service

Keisha Payson
University of Southern Maine, Muskie School of Public Service

Rod Melanson
University of Southern Maine, Muskie School of Public Service

Fred Dillon
University of Southern Maine, Muskie School of Public Service

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Capstone Project Report

Keisha Payson, Rod Melanson, Doug Roncarati and Fred Dillon

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Muskie School of Public Service – University of Southern Maine
Faculty Advisor: Charles Colgan

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LIST OF ABBREVIATIONS

BMP Best Management Practices

CSO Combined Sewer Overflow

CWA Clean Water Act

EPA Environmental Protection Agency

IC Impervious Cover

LID Low Impact Development

MCM Minimum Control Measures

MS4 Municipal Separate Storm Sewer System

NPDES National Pollutant Discharge Elimination System

NPS Nonpoint Source

TMDL Total Maximum Daily Load

WMP Watershed Management Plan

EXECUTIVE SUMMARY

The passage of the Clean Water Act (CWA) in 1972 resulted in significant improvements to the Nation's water quality. However, despite considerable time, effort and expense approximately 40% of water bodies in the U.S. are still impaired by pollution and fail to meet water quality standards (NRC, 2008). One of the most significant sources of this impairment is stormwater runoff from municipal separate storm sewer systems (MS4s). Consequently, the Environmental Protection Agency (EPA) established additional standards under the Clean Water Act that specifically target stormwater pollution from MS4s.

There is an increasing body of evidence indicating that even with these additional regulations, many of the Nation's water bodies are still failing to attain water quality standards. The EPA recently proposed strengthening MS4 stormwater standards to further reduce polluted runoff from MS4 communities. This proposal is currently under review and while its outcome is uncertain there is little doubt that more stringent standards will increase the cost and complexity of municipal stormwater program management.

To gain a better understanding of how regulated municipalities in northern New England are addressing current stormwater rules and anticipating future stormwater rules, detailed questionnaires were administered through interviews to eleven MS4 communities in Maine, New Hampshire and Vermont during the winter of 2010 – 2011. The questionnaires gathered specific information on the following four major components of municipal stormwater program management:

1. Motivations for establishing stormwater management programs;

2. Tools and / or techniques to reduce impacts from stormwater pollution;

3. Why and how particular stormwater management approaches were selected; and

4. Financing strategies and funding adequacy for current and anticipated future stormwater management program needs.

The primary motivation to address stormwater management for all study participants was federal NPDES Phase II regulations[1]. Other catalyzing events such as flooding, advocacy organizations, and staff / local official involvement played secondary roles in the development of these programs. In many cases the more "progressive" stormwater programs were linked to the close involvement of staff and / or advocacy organizations (i.e., "local leaders"). While many MS4 communities are somewhat cautious in their response to stormwater regulations, others have less trepidation about implementing programs to address polluted stormwater runoff through land use planning and zoning controls, on-site low impact development (LID)[2] techniques, creative financing strategies, and watershed-based planning.

The overall differences in stormwater management program approaches proved to be relatively small. All of the study participants are currently meeting their regulatory obligations (or earnestly attempting to do so). However, water quality impairments still exist in all MS4 communities responding to the questionnaire and to some extent are not getting appreciably better. None of the study participants have discovered a "silver bullet" to address their stormwater management challenges and must instead rely on a variety of strategies. Very few MS4 communities mandate LID techniques while most employ similar shoreland / resource protection zoning provisions in their ordinances and follow a similar approach in reviewing

[1] Phase II of the National Pollutant Discharge Elimination System (NPDES) stormwater program established regulations for "small MS4" communities (those with populations of less 100,000) to reduce the discharge of pollutants.
[2] Low Impact Development is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible.

proposals for new development and redevelopment projects. Not surprisingly, nearly all communities are challenged to fully finance their stormwater programs. Some of the larger contrasts between study participants exist in stormwater program financing strategies and the specific provisions included in local stormwater performance standards.

Juxtaposing the questionnaire results against the relevant literature highlights some of the stormwater program management challenges and implications for the study participants (and for small MS4 programs nationally). The most significant conclusions include:

- Current regulatory approaches to municipal stormwater program management do not appear to be resulting in substantial improvements to local and regional water quality (i.e., the number of water bodies designated as impaired has not decreased substantially).
- MS4 stormwater managers will need to begin conducting assessments to establish more direct connections between program activities and local water quality improvements.
- The primary motivations for most MS4 communities to establish and implement stormwater management programs are regulatory rather than environmental (i.e., to address NPDES Phase II requirements as opposed to watershed restoration concerns)
- Local land use planning and zoning ordinances will become increasingly important in reducing stormwater pollution, and will need to consider development impacts at the site level (stormwater management systems) and watershed scale (impervious coverage %).
- Accommodating higher density development with proper stormwater management systems improves water quality on a per capita watershed scale basis provided that the planning and placement of development is coordinated.

- The use of LID techniques and "green infrastructure" will need to become much more common and widespread to meaningfully address polluted stormwater runoff from MS4 communities.
- Stormwater program management will likely become more expensive so that MS4 communities will increasingly need to consider alternate and sustainable funding sources.
- The actual costs of MS4 stormwater program management will need to be better identified and understood to enable adequate planning and preparation for future stormwater program needs and requirements.

The study authors hope that these conclusions and this report more generally will be useful to other northern New England MS4 communities that must adapt to changing stormwater program regulations.

I. INTRODUCTION

A. Stormwater Regulation in the United States

1. Background

Water has long been used as an effective means to transport the waste products of human communities. The ancient cities of Mesopotamia employed rudimentary open-channeled drainage systems to convey stormwater and sanitary wastes (the prototypical "combined" sewer systems). As cities throughout the world grew, so did the water resource and public health problems associated with increasing population densities. In the mid-1800's, the River Thames was essentially an open sewer for the offal of London's three million inhabitants and cholera epidemics were a regular occurrence there.

The United States experienced similar water resource and public health challenges as its cities expanded. From the advent of the Industrial Revolution through the Second World War, the American economy rose quickly to a position of global prominence. However, during this same period the quality of America's water resources experienced a precipitous decline. Fires on rivers that flowed through industrial cities were so common that they were barely noted by news organizations.

In response to these threats to the Nation's water quality, Congress enacted the Federal Water Pollution Control Act in 1948 to establish some basic protections. This law proved to be largely ineffectual, however, and when the Cuyahoga River in Cleveland caught fire in 1969 it attracted enough national public attention to galvanize the political will needed to establish more effective legislation. In 1972 Congress enacted sweeping amendments to the Water Pollution Control Act through the creation of the Clean Water Act (CWA), for which Maine Senator Edmund Muskie was a chief and essential architect.

The CWA established the National Pollutant Discharge Elimination System (NPDES) that authorized the Environmental Protection Agency (EPA) to issue permits for "point source" pollution discharges, which originate from a single discrete pipe or outfall. The subsequent permitting of commercial and industrial point source discharges and construction of municipal water pollution control facilities throughout the 1970's and 1980's resulted in appreciable improvements to water quality.

Despite these considerable efforts and expenses, water quality problems persisted as evidenced by the continuing failure of many surface waters to meet federal water quality standards. Ongoing research identified "nonpoint sources" (NPS) of pollution – which originate from diffuse locations throughout the landscape – as significant contributors to water quality degradation. Consequently, further amendments were made to the Clean Water Act in 1987 to address NPS pollution from a variety of previously unregulated activities and sources, such as construction, forestry, agriculture and – perhaps most notably from a municipal perspective – stormwater runoff.

2. Stormwater Policy and Legal Framework

There are several levels of regulations addressing stormwater pollution with which municipalities are required to comply (Figure 1). Indeed, the primary motivation for implementing municipal stormwater management programs is to avoid the penalties (and negative publicity) associated with regulatory noncompliance. At the federal level, most of these regulations derive from the Clean Water Act which established the goal of restoring and maintaining the biological and chemical integrity of waters throughout the country. Phase I of the NPDES Municipal Separate Storm Sewer System (MS4) Program was established in 1990 to

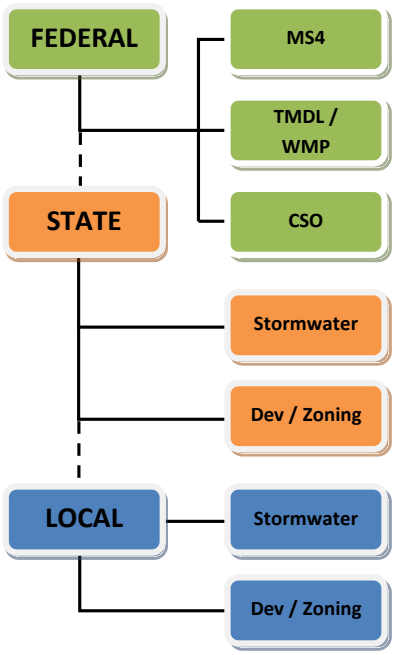

Figure 1: stormwater regulations for various levels of government

address stormwater pollution from "medium to large" urbanized areas as defined by the US Census Bureau. These MS4 systems generally served populations of 100,000 or more. Phase II of the NPDES MS4 Program became effective in 2003 for "small" systems in urbanized areas not already covered by Phase I requirements. For both Phase I and II, the overall goals of the MS4 Program were to:

- Reduce the discharge of pollutants to the "maximum extent practicable";
- Protect water quality; and
- Satisfy the appropriate water quality requirements of the Clean Water Act.

More specifically, the Phase II program required the implementation of six Minimum Control Measures (MCMs) to significantly reduce pollution to receiving water bodies. These MCMs consist of:

- ***MCM1 - Public Education and Outreach:*** distribute educational materials and conduct public outreach to inform citizens about the impacts polluted stormwater on receiving water quality.
- ***MCM2 - Public Participation and Involvement:*** provide opportunities for citizens to participate in stormwater management program development and implementation.
- ***MCM3 - Illicit Discharge Detection and Elimination:*** develop and implement an enforceable plan to conduct routine inspections of stormwater systems to eliminate illicit pollutant discharges to receiving waters.
- ***MCM4 - Construction Site Runoff Control:*** develop and implement an enforceable plan to minimize sediment transport to receiving waters from construction activities disturbing more than 1 acre of land.

- ***MCM5 - Post-Construction Runoff Control:*** develop and implement an enforceable program to minimize polluted stormwater runoff to receiving waters from completed new development or redevelopment projects.

- ***MCM6 - Pollution Prevention and Good Housekeeping:*** develop and implement a training program to minimize stormwater pollution from municipal activities.

Figure 2: MS4 program Minimum Control Measures (MCMs)

Current MS4 program requirements do not have any effluent discharge limits associated with the Minimum Control Measures. Consequently, there is an inherent disconnect between MCM activities and the documentation of actual measurable improvements to receiving water quality. According to the EPA's most recent National Water Quality Inventory (EPA, 2009):

- About one quarter of all rivers and streams in the country were assessed in 2009. Of these, half were found to be impaired
- Just over 40% of all lakes, ponds and reservoirs were assessed with 66% found to be impaired
- Just over 20% of all bays and estuaries were assessed with 64% found to be impaired

Total Maximum Daily Loads (TMDLs) also originate from the federal Clean Water Act and require states to establish lists of impaired waters (e.g., those not meeting applicable water quality standards). These waters must be prioritized for restoration through the development of TMDLs, which identify the maximum amount of pollution a water body can receive while still attaining water quality standards. TMDLs also usually provide general restoration recommendations and establish timelines for attaining compliance with water quality standards. Common TMDL types include those for nutrients, bacteria, dissolved oxygen and impervious cover[3] or flow. These latter two types are being used increasingly in urbanized areas and are intended to serve as surrogates for the suite of pollutants commonly associated with stormwater runoff. However, while TMDLs set allocations for specific pollution sources and can establish effluent discharge limits, they typically do not require enforceable controls on these sources (Owen, 2010 p. 21). Consequently, TMDLs have proven to be largely ineffective at improving water quality – particularly in urbanized areas.

To address the nonspecific nature of the restoration recommendations offered in TMDLs, EPA and state regulatory agencies have been promoting watershed-based plans (more commonly referred to as Watershed Management Plans or WMPs). WMPs are usually developed by municipalities with impaired waters following the completion of a TMDL and are entirely voluntary. They provide a detailed road map for how to achieve attainment of water quality standards and must contain the following nine key elements (EPA Watershed Handbook, p. 2-15):

a. Identify causes and sources of pollution that need to be controlled
b. Determine load reductions needed
c. Develop management measures to achieve goals

[3] Impervious cover is any hardened surface – such as paved roads, parking lots, roofs and maintained turf areas – that impedes or prevents the infiltration of water into the ground.

d. Develop implementation schedule
e. Develop interim milestones to measure progress toward meeting watershed goals
f. Develop criteria to measure progress toward meeting watershed goals
g. Develop monitoring component
h. Develop information / education component
i. Identify technical and financial assistance needed to implement plan

This last element is very important since the management measures specified in WMPs can be quite expensive to implement depending on the nature of the impairment. And while EPA-approved WMPs enable access to federal grant monies for implementation work (i.e., "on the ground fixes"), the actual costs to fully attain water quality standards are often much greater.

Combined Sewer Overflow (CSO) regulations relate closely to municipal stormwater regulations although from a programmatic perspective CSOs and MS4s are often managed and funded separately. CSOs consist of both stormwater and sewer piping systems that are connected together and result in the discharge of sewage to surface waters during significant rain events. This is particularly true in areas that were urbanized prior to the latter part of the 20th century when construction practices tended to combine stormwater and sewer piping systems or use a single piping system to convey both stormwater and sewage.

Current federal CSO regulations require municipalities to develop plans that will either separate stormwater and sewer systems or add capacity to the combined system so raw sewage discharges are eliminated. Thus while many of the regulatory compliance issues associated with CSO operations can be directly attributed to stormwater runoff the reverse is generally not true. Indeed, stormwater regulations prohibit any "non-stormwater" discharges into municipal stormwater systems (as clearly indicated by

the "separate" in Municipal Separate Storm Sewer System). Therefore, CSO considerations will not be a major focus of this paper aside from how they relate to stormwater financing.

Many states have received delegation from EPA to administer MS4, TMDL and CSO programs. Moreover, many delegated states have also developed their own stormwater management standards that can be more stringent than federal standards. The same can be true of municipal governments that receive delegation from their respective states to administer state regulatory programs related to stormwater management. Additionally, municipalities are increasingly developing local ordinances that establish stormwater performance standards for new development or redevelopment projects.

The relatively recent proliferation of stormwater management regulations at all governmental levels derives from the fundamental fact that polluted stormwater runoff is the predominant reason so many of the nation's surface waters still fail to meet water quality standards. Therefore, EPA is now considering making stormwater regulations even more stringent for currently regulated entities along with adding previously unregulated entities and classes of activities. While the current regulations focus primarily on new development, greater emphasis might be placed on redevelopment projects. The EPA is also in the process of drafting basic nationwide stormwater standards that would be applicable to previously unregulated communities.

Given the high likelihood that most regulated MS4 communities will soon have to meet increasingly stringent stormwater standards along with the ongoing difficulties many of these communities are already experiencing in complying with existing regulations, this paper investigates how communities in northern New England have addressed stormwater management obligations and how they might do so more effectively. These considerations are particularly relevant in light of predictions that the region will experience a 2-14% increase in precipitation over the next century as a consequence of global

climate change (Hart 2009). Current estimates from reputable climate scientists indicate that this region will experience an increase in the frequency and intensity of large rain events, which may have considerable impacts on local watersheds and stormwater infrastructure (Frumhoff, 2008).

Municipalities that start planning now for larger stormwater system capacity in the future can minimize the costly environmental and financial consequences of waiting until it becomes too late. Reacting to the consequences of flooding such as damaged roadway infrastructure, private property damage and contaminated streams and bays is generally much more expensive than planning proactively to avoid these mishaps in the first place. Such responses inevitably invoke the Planner's maxim of "failure to plan is planning for failure."

B. Study Methodology

The overall study methodology consisted of administering a questionnaire (Appendix A) to eleven MS4 communities in northern New England with well-established stormwater management programs (Figure 3). The questionnaire was developed through an extensive review process with several prominent stormwater professionals in Maine to summarize the most relevant aspects of municipal stormwater program management including:

- The primary motivations for each MS4 community's approach to stormwater management;
- the tools or techniques used by each MS4 community to reduce the impacts of stormwater pollution;
- the rationale each municipality used in selecting particular tools or techniques for stormwater management over other possible options;
- the real or perceived barriers hampering the implementation of low impact development techniques and / or watershed-scale planning tools and how these barriers were overcome; and

- the current financing approaches used to fund stormwater program management and whether other funding options have been or will be considered.

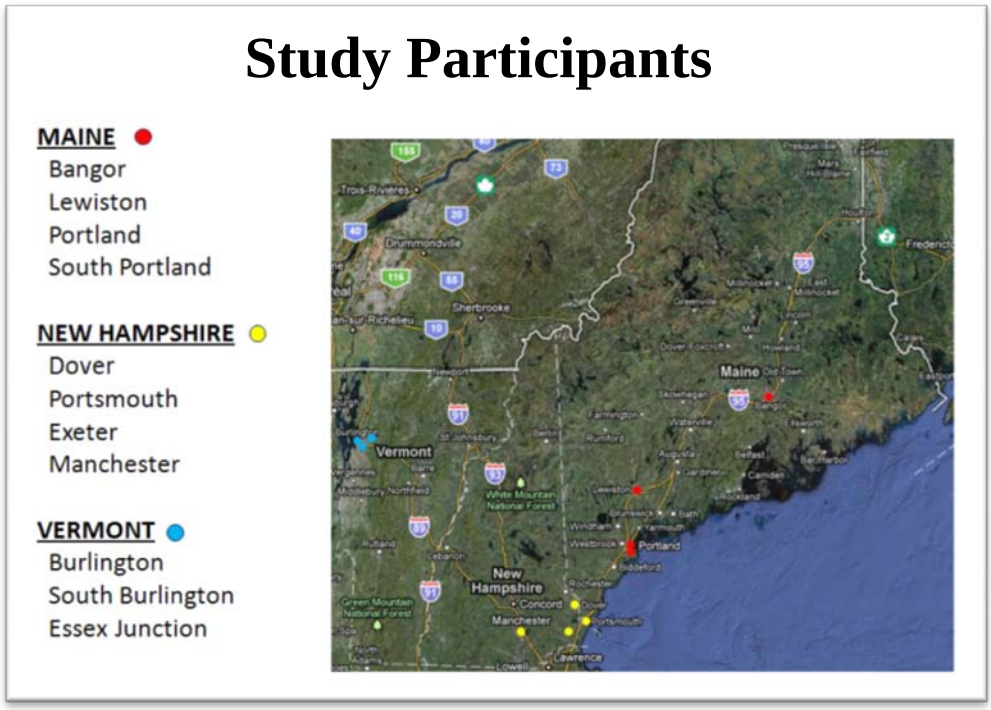

Figure 3: Geographic extent & locations of MS4 communities that completed questionnaire

The communities selected for the study were recommended by watershed managers and stormwater professionals in each of the three states. All relevant municipal staff involved in stormwater program management for the subject communities were invited to respond to the questionnaire. Common examples include municipal engineers, stormwater program managers, public works and planning department staff, water pollution control personnel and in one case an elected official.

Interviews were conducted both in person and over the phone by one or more members of the Capstone team and augmented with e-mail exchanges and website research as necessary. A digital voice recorder was used in most cases to capture all relevant questionnaire responses. While the questionnaire provided prompts for many of the queries, open-ended responses were also encouraged to provide a greater depth of understanding for the various stormwater management program components.

The findings of this research paper were informed by the questionnaire. The topic areas of the questionnaire are: community motivations; municipal planning; watershed planning; on-site stormwater treatment practices; and finally, financing stormwater management. Each section of the paper includes an overview of the major topic area, a discussion of relevant literature, a summary of the questionnaire responses, and an analysis of how the current literature either compliments or contrasts with the study findings.

II. MOTIVATIONS FOR DEVELOPING STORMWATER MANAGEMENT PROGRAMS

A. Overview

There are various factors that motivate a community to clean up its polluted waterways. The Puget Sound Acton Team (2005) created a guidance document for communities participating in the Puget Sound Water Quality Management Plan explaining how to develop a comprehensive stormwater management program. It includes a section on the "Benefits of Developing a Comprehensive Stormwater Program," which begins with the following statements:

> *"Developing a comprehensive stormwater program can help a community in many ways. Managing stormwater runoff appropriately helps reduce flooding and protects private and public property. It helps protect human health, aquifers, and drinking water supplies. It helps protect area streams, wetlands, bays, shellfish growing areas, and fish and wildlife habitat. And it can help a community come into compliance with state and federal mandates and expectations" (Puget Sound Action Team, 2005).*

It further states that "(l)ocal governments identified to be covered by the Phase II permit should be well positioned to meet permit requirements if they have developed a comprehensive stormwater program" (Puget Sound Action Team, 2005). The PSAT provided a very compelling list of reasons and motivations that would be applicable to nearly any MS4 community confronted with the need to develop a stormwater program. It also establishes a clear framework for determining whether the communities interviewed for this study were motivated to develop their stormwater management programs for these or other reasons.

In their research on government innovation in developing stormwater programs, White and Boswell (2007) state that "because the NPDES Phase II stormwater program allows flexibility in how MS4s

respond, local governments can satisfy the six Minimum Control Measures with existing activities." They found that in Kansas 38% of the Best Management Practices (BMPs) required under the MCMs had already been at least partially implemented prior to the regulations, while 62% of the BMPs required under the MCMs were put in place as a result of federal regulations, indicating that the NPDES Phase II program prompted a fair amount of innovation on the part of local governments (White and Boswell, 2007). Northern New England MS4 communities were also using many of the required BMPs prior to NPDES Phase II regulations and have found creative solutions to meeting the additional stormwater permit requirements.

The first section of the questionnaire investigates the rationale and motivating factors that led to the creation of stormwater management programs in the communities interviewed for this study. It also examines how these communities developed their programs and why they adopted the approaches they did. Several questions were developed to explore these issues:

- What were the reasons for making stormwater management planning a priority?
- If responding to regulatory requirements in developing your stormwater management program, what approaches did you consider?
- How were the elements of your stormwater management program identified, analyzed and selected?

B. Interview Results

1. Reasons for Making Stormwater Management Planning a Priority

State and federal regulations were, by far, the primary reason that study participants developed stormwater management programs. All eleven municipalities participating in the study listed Clean

Water Act compliance as a major driving force behind their program, although some placed more emphasis on CSO abatement and flood mitigation (e.g., Manchester, NH & Portland, ME) before turning their attention to NPDES Phase II and MS4 permitting requirements. Others, like South Portland, ME and Dover, NH, took a more proactive response to stormwater planning having seen NPDES Phase I and larger Phase II MS4 communities struggle to meet water quality regulations.

Although the Puget Sound Action Team listed many environmental protection benefits for adopting stormwater programs, none of the interviewed communities listed environmental concerns as their *primary* reason for developing stormwater programs. However, seven municipalities did state that environmental protection was an important motivating factor, particularly with respect to improving water quality in impaired waters.

Citizen action did not seem to be a major motivating factor for developing a stormwater program, but it influenced the programs of several communities, particularly when residents had some catalyzing event or some compelling issue to unite around.

- In Portland, the impacts that combined sewer overflows were having on the Back Cove and Casco Bay became a rallying point for the Friends of Casco Bay (FOCB) and the Bay Keeper. FOCB's outreach, education and lobbying activities, along with their willingness to constructively participate in a variety of local and regional water resources planning efforts, have significantly influenced the progression of Portland's CSO abatement program.

- In Bangor, strong public outcry about the impacts of development on Birch Stream focused attention on the issue of stormwater runoff. Alerted to the problem, the Maine Department of Environmental Protection (DEP) started monitoring the stream and subsequently declared that the brook did not meet water quality standards. The DEP placed Birch Stream on the State's

303(d)[4] list of impaired waters and developed a Total Maximum Daily Load (TMDL)[5] to address impairments. In response, the City conducted additional water quality monitoring to verify the DEP's findings and developed a watershed management plan to address water quality problems.

- The Town of Exeter, NH became alarmed when three rivers in their community were placed on the state's 303(d) list. Town officials made a concerted effort to learn about the problem of nonpoint source pollution and became well-versed in the principles of Low Impact Development (LID). They then shared this information with other municipal staff, elected officials and developers and promoted the use of LID in their community.

Only a few communities indicated that fear of legal action factored into their decision to develop or ramp up their stormwater programs. South Portland and Portland, both significant stakeholders in the Long Creek Watershed Restoration Program (centered in the area of the Maine Mall), stated that the EPA's decision to exercise its Residual Designation Authority[6] and force landowners to address water quality impairments in the watershed influenced development of their stormwater management programs. Officials from Burlington, VT said they were concerned that the Conservation Law Foundation might appeal development permits in their community. Essex Junction also expressed some concern about development permit appeals and legal challenges to a lesser extent.

2. Approaches Considered When Developing Stormwater Management Programs

MS4 communities interviewed for this study universally designed their programs around one central stormwater regulatory framework: MCMs required under the MS4 permit. As outlined in the

[4] Section 303(d) of the 1972 Clean Water Act requires states, territories, and authorized tribes to develop lists of impaired waters that do not meet applicable water quality standards.
[5] A TMDL identifies the maximum amount of total pollutant loading a water body can receive while still attaining water quality standards and sets pollutant allocations for specific pollution sources.
[6] EPA may "residually designate" additional stormwater discharges as requiring NPDES permits when controls are needed based on TMDL waste load allocations or when stormwater discharges contribute to a violation of water quality standards or significantly contribute pollutants to waters of the United States.

introduction, MCMs establish a variety of activities in six major program areas that MS4 communities must implement to comply with the NPDES Phase II regulations (Figure 2). The MS4 permit and associated MCMs establish the baseline program requirements and the goal of many communities was simply to comply with these minimums. Implementation of the MCMs was seen as a means to move closer to compliance with TMDLs in impaired watersheds. Nearly all of the participating municipalities considered TMDLs as having a role in their stormwater programs.

Burlington, Lewiston, Manchester, Portland, South Portland and to a lesser extent, Bangor, indicated that CSO abatement efforts, required under the Clean Water Act, figured prominently in their approach to stormwater management and water quality improvement. Bangor found that even after eliminating 21 out of 26 CSOs, water quality was still impaired, prompting them to look more closely at TMDLs and the development of watershed management plans.

Even though WMPs deriving from TMDLs are EPA's preferred approach to addressing water quality impairments in 303(d) listed waters, relatively few communities considered using them when developing their stormwater management plans. Bangor has made watershed management planning a priority of their stormwater program because, unlike TMDLs, watershed management plans provide a specific "road map" aimed at restoring water quality in impaired watersheds.

Portland developed greenway master plans for Capisic Brook and Fall Brook as part of its comprehensive approach to dealing with flooding and CSO problems, but it did not have the resources or public and political support to implement them. The need for watershed management planning was considered by Portland when it was developing its MS4 program and it did participate in the Long Creek Watershed planning process led by South Portland. However, it wasn't until 2009 that the city engaged in its own watershed planning effort, developing a draft Capisic Brook Watershed Management Plan.

Like Portland, Manchester and Burlington also factored watershed management planning into their stormwater management programs, but primarily as an outgrowth of their CSO abatement programs rather than as separate independent efforts.

The use of Low Impact Development[7] (LID) practices was not considered by many municipalities when they were creating their stormwater management programs. Burlington, Exeter and Essex Junction are among the standouts in this category, because they incorporated LID practices into their programs early on in the process. Bangor incorporated the use of LID into its watershed management plans, mainly because DEP encourages it as a watershed restoration tool. South Portland and Portland have started promoting it only more recently and while they do not have standards, they are open to the use of alternative development plans and green infrastructure if they are well-conceived.

Several communities decided to participate in regional stormwater planning efforts, rather than going it alone. Maine and New Hampshire have taken leading roles in the use of regional stormwater planning as a means of supporting local stormwater program development efforts. The Interlocal Stormwater Working Group (ISWG), supporting the Greater Portland area, and the Bangor Area Stormwater Working Group (BASWG) allow a number of MS4 communities to combine their limited resources to achieve compliance with a variety of permit requirements such as training, outreach & education, research, and policy negotiation with state regulators. These partnerships also provide a forum for collaborating with state regulatory agencies, local environmental groups and others. New Hampshire has a similar regional stormwater planning effort: Dover, Exeter and Portsmouth participate in the

[7] LID techniques are stormwater management practices that attempt to mimic natural hydrology by storing stormwater on-site, filtering it to remove pollutants, and in many cases infiltrating it into the groundwater below.

Seacoast Stormwater Coalition, while Manchester takes part in the Manchester Area Stormwater Group. Likewise, MS4s in Vermont have established Smart WaterWays through the Chittendon County Regional Planning Commission.

3. Process for Developing Stormwater Program Components

State and federal water quality regulations served as the foundation for developing stormwater programs in all of the communities interviewed. Some communities, like Portland, South Portland, Bangor, Dover, Manchester, and Burlington began with CSO abatement programs under the CWA. When the Phase II stormwater regulations and MS4 permit came out they identified the things they were already doing to meet the MCMs and determined what additional program components were needed to comply with their permit. Communities without CSO issues also tended to take this approach to developing their programs. Portland and South Portland also looked to the ISWG for assistance in crafting their stormwater programs and meeting the additional permit requirements.

C. Implications

It is not surprising that the primary driving force behind stormwater management programs for these eleven communities appears to be state and federal water quality regulations, particularly the NPDES Phase II regulations and MS4 permit. These regulations spell out what a community must do to stay in compliance with their MS4 permit. Since there are real and significant costs associated with the MCMs, it is no wonder that most communities are willing and able to do the minimum that is required of them.

These communities expressed frustration with the Clean Water Act's use of TMDLs to address nonpoint source pollution in impaired watersheds. While these documents identify the pollutants of concern for a particular watershed and provide some numerical targets for reducing pollutant loadings, they do not provide specific and detailed guidance for restoring water quality. Further, there is no requirement for

communities to take the next step and develop watershed management plans to address water quality impairments, nor is there a solid link between the MS4 permit requirements and implementation of TMDLs. Absent specific detailed guidance and link to permit requirements, municipalities are likely to continue to focus on implementation of the MCMs and only engage in watershed planning as a means of fending off potential enforcement actions or legal challenges.

The results of this study indicate that, at least for these communities, environmental protection is important, but not the primary reason they have developed stormwater programs. This is likely due to a poor understanding of the water resource problems associated with polluted stormwater runoff by many residents, developers, community leaders, planners and policy-makers. Even if community awareness is raised and the need to address these problems is made apparent, the solutions are complex, costly and challenging to implement.

III. Municipal Planning to Reduce the Impacts of Polluted Stormwater Runoff

A. Overview

Stormwater management is only one of the many considerations that municipal planners must address when determining how and where development can occur within their communities. Planners by practice attempt to focus on creating rules regulating land use that lead to the implementation of so-called "sustainable" development – that which has the least impact on the community character, natural environment, and lends itself to a higher quality of life within the community.

Aside from the many other factors that determine where and how development occurs, municipal planners and stormwater program managers in Northern New England must also attempt to anticipate how more stringent stormwater regulations could affect future standards for new development and redevelopment projects. A common complaint from the planning community in Maine is that more stringent stormwater management regulations in developed areas will inevitably lead to sprawl. Superficially, it appears to planners that state and federal regulations hamper local land use planning and smart growth approaches (where smart growth is simply understood as denser development).

During the revision process for the Maine DEP's Chapter 500 stormwater management rules in 2005, many planners complained that stricter stormwater standards in defined growth areas would push development to "green fields" since stormwater standards were more lax in these areas. Many planners also objected to provisions in the revised regulations that required development projects with permits granted before the rule change to comply with the latest rules. Planners also believed that the updated stormwater rules placed significant limitations on new development and redevelopment in areas with existing infrastructure. Consequently, Maine's Chapter 500 was perceived by many as a sprawl-promoting regulation that made it more difficult to implement the housing and commercial development

densities needed to support smart growth approaches. In many respects, this perception was largely justified based on increased permitting costs and permitting review times and additional costs associated with new stormwater infrastructure.

Nationally, the question of whether stormwater regulations conflict with or support smart growth principles has received considerable attention. Current literature on this topic is extensive and recent reactions to EPA's proposed strengthening of MS4 regulations indicates significant interest and concern on the part of state and local governments. EPA has attempted to reconcile this potential conflict by concluding that "low-density development may not always be the preferred strategy for protecting water resources. Higher densities may better protect water quality – especially at the lot and watershed levels (Richards, 2006)." Moreover, zoning for growth areas at higher densities that support walkable communities may translate into reduced stormwater pollutant loads on a per capita basis in comparison to lower density development **(**Jacob, 2011). Thus, there does appear to be a growing recognition among planners that sound stormwater management practices and smart growth principles are closely related.

Our findings from interviews with Northern New England MS4 communities provide information about the role stormwater management plays at the site development and watershed planning scale while also offering insights into how well planners actually plan for water quality protection.

B. Stormwater Planning in Study Communities: Techniques and Tools

Typically, storm-water management is a function of the local department of public works and / or the wastewater treatment department. The engineering and on site facilitation of stormwater management is handled in more of a technical manner within these departments; however, *land use policies*, including stormwater management are typically addressed through local planning departments.

1. Role of State and Federal Regulations

Following the establishment of the Maine DEP's Chapter 500 stormwater regulations[8], some Maine communities have incorporated similar language into their local ordinances. Similarly, Vermont rewrote their standards to comply with the CWA. Vermont, like Maine, is delegated to administer federal stormwater regulations while New Hampshire instead chose to rely upon the regional EPA office to issue MS4 permits.

As the study communities developed their local ordinances, they could choose to be stricter than state or federal standards but they could not choose to be less strict. For example, South Portland developed stormwater standards that lower the development review threshold from the one acre standard specified in Chapter 500 to 15,000 ft^2. Maine communities worked closely with DEP to develop local standards and relied heavily on the state's technical guidance and approval process for stormwater rules[9]. This was evidenced in Bangor, where the city has relied heavily upon Maine DEP staff for guidance as they prepare to implement stormwater management strategies. Burlington, Vermont's stormwater rules are far stricter than the minimum standards required by the state and their permit review threshold is set at 400 ft^2 of disturbed area (versus the state's 1 acre minimum)[10]. By reducing the minimum thresholds, more impervious acreage may be reviewed locally which could help to reduce overall cumulative impacts from polluted stormwater runoff. This also provides the community with a better opportunity to understand stormwater treatment practices at the site level and ultimately gives stormwater managers a more detailed perspective of the developed landscape.

[8] Stormwater performance standards developed by the Maine DEP to prevent and control the release of pollutants to the state's waters, and reduce impacts associated with increases and changes in flow.
[9] Appendix B - Meeting Notes for Stormwater Survey Questions and Interviews - South Portland ME
[10] Appendix B - Meeting Notes for Stormwater Survey Questions and Interviews - Burlington VT

2. Role of Local Zoning: Incentives, Overlays and Resource Protections

Based on a review of local stormwater standards, there were very few instances where incentives were used to promote development in growth areas as opposed to more rural areas (e.g., transfer of development, development offsets, impact fee waivers, etc.). While empirical evidence clearly demonstrates that higher density developments provide better water quality results at the watershed scale (Jacob and Lopez, 2009), establishing incentives to develop in growth areas through zoning language may be difficult to achieve. This would involve the expensive proposition of either retrofitting existing stormwater treatment structures or building new ones to address the water quality and quantity issues associated with denser development. The Long Creek Watershed Management District (LCWMD) – a cooperative effort between 4 municipalities, 2 transportation agencies and over 100 private businesses in the Maine Mall area – offers an instructive example. According to Tamara Lee Pinard, Executive Director of the LCWMD, current estimates for what it has cost to provide stormwater treatment are approximately $100,000 per acre of impervious area.

The concept of preventing further degradation to water quality in rural areas is a common theme in watershed planning but is not addressed within the stormwater zoning language of most MS4 communities. Simple zoning practices that could accomplish this would be setting higher setback standards for surface waters in rural areas versus those in growth areas. Depending on watershed boundaries, this could achieve the higher densities advocated in current research to address stormwater quality and quantity issues. Scarborough, Maine provides a useful example through the establishment of their 250' stream protection district (as opposed to the common 75' setback where a development transfer is allowed). Landowners who are "burdened" by the stricter protection district are allowed higher densities on other portions of their lot or on other parcels within a designated growth district – provided that an easement is placed on the 250' riparian area (Scarborough, Town of. n.d.). This is

consistent with the concept of watershed scale planning for the attenuation of stormwater pollutants (discussed in more detail later).

Another strategy that could help protect water quality in developing watersheds would be to set target densities for designated growth areas while also establishing permanent protections elsewhere in the watershed. A recent Journal of American Water Resource Association article described the use of a simple impervious cover model to demonstrate how per capita pollutant loadings and runoff volumes decreased markedly with increases in development density at the watershed scale (Jacobs & Lopez, 2009). Many of the study communities have permit requirements that specify a timeframe for water quality standards to be met. Zoning changes are a far more long-term remedy and perhaps would not show results to water quality improvements within these required time frames (usually around 10 years). However, zoning techniques still represent an essential element in the planner's toolbox to assist in meeting watershed planning goals (Lemoine, 2007).

South Burlington, Vermont developed a Stormwater Management Overlay District. All development within the overlay is subject to the standards found within the ordinance, with an exemption for anything less than 5,000 ft^2. The overlay ordinance requires all development within the district to include BMPs that manage stormwater runoff. The BMPs as defined in the ordinance address illicit discharges from private properties and include the maintenance of a pollutant free watercourse (e.g., contamination, flow reduction, etc.). Ordinance language authorizes the Stormwater Superintendent to identify the acceptable BMPs that will help meet water quality goals. This approach is also a form of watershed scale stormwater management. Although it does not address the growth area vs. non-growth area scenario mentioned above, it is consistent with the City's Stormwater Management Plan. South Burlington's ordinance also ensures that on a per parcel basis, development incorporates the appropriate BMPs. It also includes provisions that establish the basis and rationale for a Stormwater User Fee. The

fee system incentivizes practices that reduce impacts from polluted stormwater runoff by reducing rates for property owners who remove impervious cover.

Overlay districts, coupled with stormwater management plans, offer some of the more sophisticated approaches to municipal stormwater management. The attributes of an overlay district recognize watersheds as a means for planning. The actual zone delineates the watershed boundaries and at the very least identifies to landowners and regulators an area of particular significance. This may serve as an excellent tool in the long run to have an existing overlay that may adopt further tools (regulations, user fees, development transfers / credits, Low Impact Development, etc.) to ensure future water quality. As for the current functions of the overlay district, it helps the planners and coordinators manage at the watershed scale in a more holistic manner.[11]

Navigating through local ordinances to determine how regulations meet water quality protection goals is a daunting task. A study on stormwater management approaches in the Washington, DC area notes that zoning ordinances (specifically overlay districts) are perceived as difficult to fund and take a long time for implementation versus on the ground improvements. Even so, overlay districts coupled with infrastructure improvements were perceived as a long term cost savings approach and water quality enhancement (Hinton 2011).

MS4 communities are focused on improving development standards through enacting local ordinances or directly complying with and administering state or federal standards. Zoning tools employed separately from stormwater specific regulations in local land use ordinances included overlay districts, shoreland zoning, wetland protection ordinances, aquifer / groundwater protection and floodplain protection ordinances (Table 1).

[11] Appendix B - Meeting Notes for Stormwater Survey Questions and Interviews - S. Burlington VT

Table 1: Zoning Summary for Study Participants

	Portland	South Portland	Lewiston	Bangor	Dover	Exeter	Portsmouth	Manchester	Burlington	S. Burlington	Essex Junction	Yes	No / ? / NA
Stormwater Ordinance	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	8	3
Wetland Protection	No	Yes	No	No	Yes	Yes (100' buf)	Yes	Yes	Yes	Yes	Yes	8	3
Shoreland Zone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes (Overlay)	Yes	Yes	11	0
Floodplain	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	9	2
Aquifer Protection	No	No	Yes	No	Yes	Yes	No	Yes	NA	No	No	4	7
TDR - Density Bonus	No	No	No	No	Yes	No	No	No	Yes (Overlay)	No	No	2	9
Watershed Overlays	No	No	Yes	Yes	No	No	No	Yes	NA	Yes (SW)	NA	4	7

Interestingly, some of the study communities that enacted stormwater specific ordinances did so independently of the community plan (whether a watershed plan or comprehensive plan). Many did consider how stormwater standards interacted with other municipal standards, such as meshing stormwater standards with landscaping standards to optimize overall site development and performance. When stormwater management is only treated as a site plan performance standard rather than a community development goal, the overall goals of the regulation can be lost. South Burlington and South Portland appear to be on a planning path that considers site regulations for better stormwater management in relation to overall watershed management planning goals. Approaches such as overlay districts, and Low Impact Development Manuals or BMPs that are referenced in the stormwater ordinance provide the connection of community development goals by clearly reflecting the desired outcomes for the built environment and water quality protections.

C. Development Review Processes

When responding to how site-specific developments are reviewed within the MS4 communities, there was a typical response among study communities of relying on local regulations, which in most cases are directly in concert with the state and / or federal regulations. To further understand how communities regulated stormwater at the local level we inquired about the processes and protocols embedded in the overall development review process. All study communities followed a development review process based on local standards. The initial staff review included comments from planning departments, public works departments, codes, and water resource staff, etc. Some communities used a review committee, such as in Dover, NH, where the committee included a representative from the Conservation Commission who consistently commented on water quality issues. The processes typically followed a framework of Planning Board review for major projects, and for small projects a staff level review.

Some of the study communities required applicants to submit development proposals with approved state or federal stormwater permits (when needed), while others simply made acquiring these permits a condition of approval. This is an important distinction since it directly relates to how a community assesses and reviews the impacts of stormwater. Having an outside agency review and permit an aspect of development may relieve some of the workload for municipal staff, but it also relinquishes some of the local controls and involvement in the review processes. Staff at the local level typically have a far better understanding of the stormwater issues in their communities than state or federal regulators (EPA).

The thresholds for development review revealed major differences in how the study communities incorporated stormwater management considerations into their development review process. South

Portland and Burlington have far lower thresholds of review that involve the codes office and engineering and / or water resource protection staff for any development. These could consist of simple drainage plan reviews to more elaborate on site treatment plan reviews depending on the context of the site. Burlington also enacted a post-construction requirement to evaluate the mitigation of redeveloped / existing impervious areas and new impervious areas. Post-construction review was common throughout local ordinances and is consistent with state / federal permitting requirements.

Another difference in the review process was the use of third parties to conduct stormwater reviews. Third-party stormwater reviews often are conducted at the expense of the landowner / developer. A third-party reviewer follows the local or state (whichever is enacted by the municipality) review standards and is considered the technical review in conjunction with municipal staff comments. Third-party reviewers are often qualified engineers contracted by the municipality. Many communities perceived this as an added burden to applicants, while others heavily relied upon an objective review to help in the interpretation of local, state and federal.

Some of the factors that may present difficulties in site-specific reviews and ordinance standards are determining the pre- and post-hydrology of sites, particularly in how closely a developed site can maintain the existing hydrology. Manchester noted that they are adding stronger "teeth" to their ordinance language to ensure that existing tree cover is maintained on site. Exeter and others have worked with consultant design engineers on the specifics of the ordinance. Consultant engineers also often serve as third party reviewers in developing the standards. Bangor's development review process was fairly typical but they are interested in establishing watershed based review approaches for site development. This would provide a meaningful link between watershed planning and site level implementation of a watershed restoration plan.

Another interesting finding is that some communities are planning sewer, stormwater and other infrastructure improvements in a manner that guides growth toward designated future higher density development areas. A watershed-based approach is crucial to this process since it can inform which areas are most appropriate for increased development densities from a water quality protection perspective[12].

Reviewing current stormwater regulations within the study communities as well as their processes of review provided a better understanding for how these communities implement their planning efforts. Frequently, planning efforts and implementation of planning efforts may encounter difficulties in achieving planning goals. Interestingly, all of the communities understood the growing importance of stormwater management within the larger context of community planning. Attitudes toward stormwater management have evolved over the years from designing and regulating strictly for hydraulic considerations (i.e., to remove water quickly) to understanding the need to minimize water quality impacts. Federal regulatory requirements have helped drive this understanding.

D. Planning Implications

The importance of development density in relation to water quality impacts cannot be overstated. Empirical research now firmly establishes a connection between smart growth approaches and stormwater management:

> *"The question was whether the reduced land consumed by higher density development (vs. standard suburban developments) would offset the worse water quality generated by*

[12] Appendix B – Meeting Notes for Stormwater Survey Questions and Interviews – Manchester NH

> *a greater amount of impervious surface in the smaller area. Total runoff volume and per acre loadings of total phosphorous, total nitrogen, and total suspended solids increased with density as expected, but per capita loadings and runoff decreased markedly with density. For a constant or given population, then, higher density can result in dramatically lower total loadings than more diffuse suburban densities (Jacob and Lopez, 2009)."*

This "denser is greener" reality strongly suggests that zoning may be one of the most effective long term tools to deal with stormwater issues – especially in smaller communities that have not yet had to deal with federal stormwater requirements. Enacting zoning that mitigates water quality impacts must be preceded by a concerted planning effort. Strong watershed protections and the implementation of restoration strategies hinge upon planning. Therefore, planners have a crucial role to play in mediating the relationship between density and water quality protection since where and how development occurs directly affects the extent to which receiving waters will be adversely impacted by surrounding development.

None of the study communities developed zoning that resulted from a watershed-based planning effort (aside from some examples of decent riparian buffer standards). Likewise, none of them used the tools that could guide development for water quality protection, such as in-lieu fees (paying funds in-lieu of conducting on-site, permittee-responsible mitigation) or utility / impact fees for a development transfer program or land bank. This latter tool would place an annual percentage of a property owner's fee in a "land bank" to purchase development rights within identified high priority water resource areas, such as riparian buffers which are the strongest components of healthy waterways (Maryland DNR website). It would also directly reflect and mitigate the impacts of developed areas and perhaps help achieve an

appropriate level of impervious cover for a given watershed. In order to conduct such programs, the planning and prioritization of these areas is fundamental. The patterns of development alone have great impacts to a watershed. Aside from specific on site performance standards, the eventual "build-out" of a particular area or watershed will need to be considered, and to effectively create this build out scenario with the least impact towards water quality the knowledge of the underlying resources and hydrological systems must be understood (Stephens, K., Graham, P., Reid, D., 2002).

Finally, while all of the study communities are attempting to meet the goals of water quality protection through a variety of regulatory mechanisms, impairments to local surface waters remain. It is uncertain whether the current mix of zoning tools and specific benchmarks in MS4 permit requirements can be combined effectively to achieve and sustain meaningful watershed protection and restoration. However, it does appear that the study communities have begun identifying more innovative tools, approaches, and requirements. This is an important development, especially given the imminence of stricter regulatory requirements. Conversely, many of the innovative water resource protection practices also come with considerable costs, which will present a real barrier for their implementation. How (or whether) communities decide to meet this challenge through planning may well determine the fate of local water resources.

V. WATERSHED-BASED STORMWATER MANAGEMENT

A. Overview

Traditional land use planning is not well suited to protecting water resources or addressing water quality impairments for a number of reasons. First, it tends to be community-based. Each municipality values their water resources differently and these values are reflected in their land use policies and management practices. However, wetlands and aquifers, rivers and streams, and lakes and coastal waters do not conform to political boundaries, meaning several communities often rely on the same water resources. One town's drainage channel can become another's wildlife area once it crosses their border and water pollution generated by urban runoff upstream can significantly impact water quality downstream or in larger receiving water bodies. Furthermore, site plan and subdivision ordinances focus mainly on site-specific issues and rarely take into account the cumulative impacts of development on water resources (Bernthal & Barrett, 1997).

A second, related issue is that traditional land use planning relies heavily on zoning to determine where certain types of development should occur within a municipality. Zoning regulations are also subject to the values of a particular municipality and therefore the impacts of development on a shared water resource can vary greatly between communities. Specialized zoning tools, including floodplain management regulations, shoreland zones, stream protection overlay zones, and aquifer protection overlay zones have the potential to provide significant water quality benefits. Together these zoning tools prohibit or restrict development near water supplies or along the edges of sensitive water bodies, both to protect the public welfare and the water resource. In doing so, they also often preserve vegetated buffers between development and the resource that help mitigate the impacts of stormwater runoff and might have the added benefit of protecting riparian wetlands. State and Federal regulations establish the

location of floodplains and set minimum shoreland, stream protection and aquifer protection standards, which promotes some degree of consistency between communities. While these tools undoubtedly contribute to water quality protection, they alone cannot mitigate all of the impacts of stormwater pollution (Bernthal & Barrett, 1997). Similarly, wetland ordinances can help to preserve wetlands that provide many important water quality benefits, such as flood storage and attenuation, filtration, and groundwater recharge. However, they do not address the root causes of stormwater pollution, namely impervious areas such as parking lots, roads, driveways, and buildings and the land uses they support. These land use tools are more effective when used within the context of a comprehensive watershed planning process (City of Boulder, 2007).

The EPA, under the authority of the Clean Water Act and NPDES, has also been working to develop regulations and permitting frameworks that limit the impacts of development on water quality and promote water quality restoration. The EPA and/or state environmental agencies acting on their behalf have developed construction and stormwater discharge permits that require developers to provide for erosion and sediment control during construction and to minimize and/or treat stormwater runoff leaving the project site. Municipalities that meet certain demographic thresholds, including urban density, are required under NPDES to obtain stormwater discharge permits for their municipal separate storm sewer systems (MS4s) if they discharge to "waters of the state" such as rivers, streams, lakes, and coastal waters. The MS4 communities, as a condition of their permits, are required to adopt local ordinances similar to state or Federal regulations aimed at minimizing nonpoint source pollution from development.

Section 303(d) of the Clean Water Act requires the EPA and/or state environmental agencies to identify the nation's impaired water bodies and set limits on the amount of pollutants that can be discharged to these waters. Once established, municipalities with impaired waters, usually regulated MS4

communities, are required to implement these Total Maximum Daily Load (TMDL) limits and restore the health of the resource for designated uses. This presents a significant challenge because the sources of stormwater pollution are variable, diffuse and difficult to characterize (Owen, 2011). Further, TMDLs identify the pollutants of concern and common sources of these pollutants (EPA, 2008), but they provide communities with little guidance about how to address the water quality impairments (Owen, 2011). However, in combination with stormwater permitting, TMDL regulations can drive municipalities towards watershed planning and management, the EPA's preferred approach (EPA, 2011).

The Center for Watershed Protection defines a watershed as "the land area that drains to a common body of water, such as a stream, lake, estuary, wetland, or even the ocean" (CWP, 2011). Watershed planning can be performed at many scales, ranging from a single brook, a river and all its tributaries or an entire lake or bay. Therefore, watershed planning might involve a single community, multiple jurisdictions or a region, depending on the scale of the effort. Unlike TMDL planning, which is focused on meeting "end-of-pipe" pollutant load limits as a means of improving water quality in an impaired water body, watershed planning looks at the broader impacts of land use within the watershed and focuses on addressing the causes of water quality degradation with the ultimate goals of both meeting the TMDL and improving water quality in the impaired water body. While a TMDL is a regulatory standard for achieving water quality improvement, watershed planning is a scalable, cooperative *approach* to reducing water quality impairments and restoring the health of a watershed.

B. Interview Results

1. The Prevalence of Impaired Waters

All 11 regulated communities participating in this study are responsible for addressing water quality impairments in at least two water bodies and 8 municipalities had five or more impaired waters (Appendix C). The number of impaired streams each municipality was responsible for ranged from two in the case of Essex Junction, VT to 14 in Portsmouth, NH. These included streams, rivers, ponds, lakes and one harbor. Together these eleven communities are responsible for restoring water quality in 73 impaired waters including 11 in Vermont, 22 in Maine and 40 in New Hampshire.

2. The Role of TMDLs

Similarly, all but one community in this study, Portland, ME, has at least one approved TMDL for their impaired waters.[13] The approach each state used to develop its TMDLs bears strongly on the number of TMDLs issued for the study communities. Until recently, Maine has developed TMDLs specific to individual pollutants of concern such as elevated bacteria counts and low dissolved oxygen levels or when information on pollutants is not available, they have defaulted to surrogate indicators of poor water quality like reduced benthic-macroinvertebrate populations or degraded habitat. Only six TMDLs are currently in effect for the four Maine municipalities included in this study. This scenario would play out similarly for New Hampshire and Vermont except for the fact that these states have developed statewide TMDLs for bacteria and "stormwater" (i.e.: as a surrogate for other pollutants), respectively, which apply to all of their impaired waters (NH DES, 2010 & VT DEC, 2011). This greatly increases

[13] Draft TMDLs have been developed for two of Portland's impaired streams, but have not been approved by the EPA.

the number of TMDLs that the regulated MS4 communities in our study must address in these two states.[14]

It is important to note that the Maine Department of Environmental Protection is developing a statewide impervious cover (IC) TMDL, which, like Vermont's "stormwater" TMDL, recognizes the wide range of pollutants found in stormwater runoff. However, it uses the amount of impervious cover within a watershed as a surrogate for pollutant loading, because there appears to be a close relationship between the amount of impervious cover and the degree of water quality impairment in watersheds (CWP, 2003). According to the Center for Watershed Protection aquatic life can be significantly impacted when as little as 10% of a watershed is covered by impervious surfaces such as buildings, roads and parking lots (CWP, 2003). Unmitigated increases in the amount of impervious cover result in changes in base flow, greater frequency of peak flow events and flooding and negative impacts on stream channel morphology, all of which significantly degrade water and habitat quality in the watercourse (Figure 4).

[14] Vermont has also developed a draft statewide bacteria TMDL that was released for public comment in May 2011.

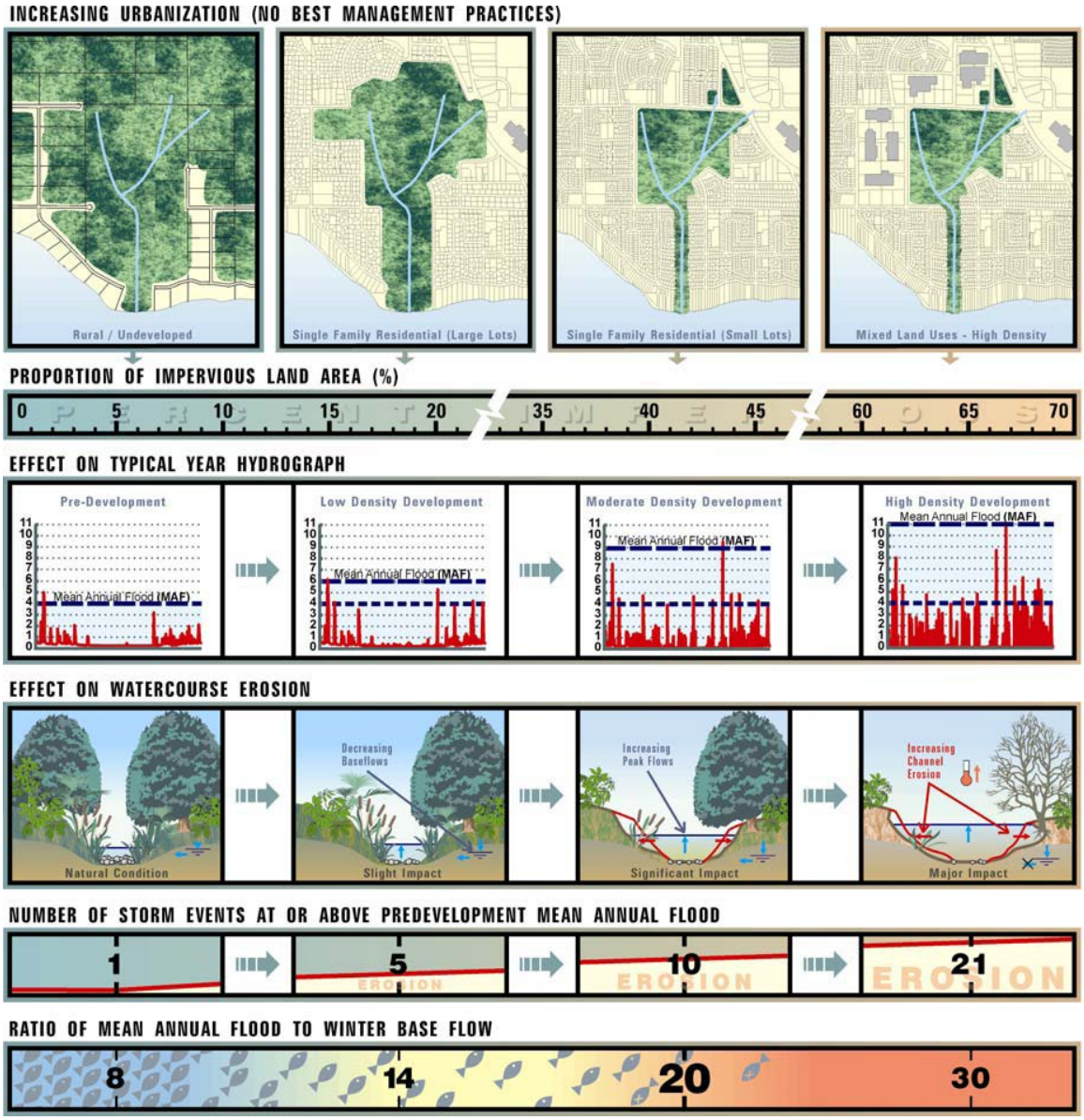

Figure 4: Relationship between impervious area and watercourse hydrology (Stephens, et al., 2002, p. 1-5.)

The goal of developing these IC TMDLs is to encourage communities to develop watershed management plans aimed at mitigating the effects of impervious cover (both existing and future), therefore reducing the impacts of urban runoff on impaired waters. In urban centers such as Portland and South Portland where some of the watersheds are more than 30% impervious, the development of IC TMDLs represents a significant challenge for municipal officials already dealing with the myriad other water quality regulations.

Generally speaking, the communities we interviewed did not think TMDLs are an effective regulatory tool for stormwater management or watershed restoration. TMDLs might provide some information about the nature of the water quality impairments in a watershed, but they do not help communities identify the sources of pollutants or develop or implement mitigation plans to address those pollutants. Several community representatives expressed that TMDLs do serve as an additional driving force behind implementing their MS4 programs and developing watershed plans.

3. Watershed-Based Planning

The emphasis on the use of watershed management plans (WMP) within each state, at least based on the 11 municipalities we studied, varies to some extent. In Maine, all four communities have developed, are developing or are subject to a watershed management plan developed by a neighboring community. Both Dover and Manchester in New Hampshire have one watershed management plan and Exeter is participating in a multi-community watershed planning exercise overseen by the Exeter River Local Advisory Committee. None of the Vermont communities we interviewed had completed a watershed management plan. However, in Chittenden County municipalities must develop "flow restoration plans" for impaired waters with TMDLs listing "stormwater" as the pollutant of concern. The goal of these plans are to use structural (i.e., engineered) and non-structural (i.e., land use policy & standards) BMPs to restore the hydraulic character of the impaired water to healthier state, reducing erosion and sediment transport, preserving stream & river morphology and protecting overall water and habitat quality. The benefit of this approach is that many of the BMPs used to restore flow characteristics in impaired waters also help to reduce the concentration of other pollutants found in stormwater runoff, which is important because water quality impacts are often the result of a mix of pollutants and physical changes to the water body (VT DEC, 2011).

C. Implications

The most startling finding is simply the scope of the challenge for these 11 regulated MS4 communities. Between them, under current Federal law, they have to find a way to restore water quality in 73 impaired watersheds. This is particularly challenging because there is a general lack of awareness – at all levels - of the problem of urban runoff and need for watershed planning and restoration. Furthermore, for municipalities struggling with a host of competing priorities, stormwater management is often given short shrift in relation to other budgetary needs or capital expenses. This is exacerbated by the fact that addressing water quality issues is quite costly and is perceived as being anti-development. During difficult economic times, like we are currently experiencing, communities are unwilling to voluntarily invest in water quality improvements and are not likely to implement policies that discourage economic growth.

Nonpoint source pollution, by its very nature, does not readily fit into the TMDL regulatory framework that was designed to control point source pollution, because the sources of stormwater pollution are numerous and challenging to identify and pollutant concentrations in stormwater are variable and difficult to quantify. For this reason, regulatory agencies are hesitant to invest the time, effort and money to conduct the water quality monitoring studies needed to develop TMDLs (Owen, 2011). In addition, TMDLs do little more than identify some of the causes of water quality impairment and establish numerical limits on amount of a given pollutant can be discharged to the impaired water. This places the burden of determining the sources of pollution and developing a mitigation plan squarely on the municipality with the impaired water body. However, in combination with MS4 permit requirements and the real threat of the use of Residual Designation Authority as was seen in Long Creek in South

Portland, Maine, TMDLs might provide the necessary impetus for communities to develop and implement watershed management plans. Vermont's use of "stormwater" TMDLs to promote flow restoration plans and Maine's decision to embrace IC TMDLs as a precursor to development of watershed management plans seems to support this conclusion.

Ultimately, the goal of the Clean Water Act and all of the regulations arising from it is to restore water quality in impaired waters so that they meet their use classifications. Unfortunately, there is no guarantee that this goal will be met, even if communities comply with their MS4 permits, meet the limits established by TMDLs and implement all of the structural and nonstructural best management practices developed for their watershed plans. Greater consideration should be given to evaluating the environmental, social and economic benefits and costs of achieving water quality goals in an urban setting.

V. ON-SITE STORMWATER TREATMENT: A REVIEW OF LOW IMPACT DEVELOPMENT

A. Overview

The past fifteen years have experienced a substantial increase in the research and implementation of new practices for addressing stormwater pollution. Rather than trying to rush stormwater off-site through storm drains and culverts, the new stormwater management techniques, called Low Impact Development practices (LID) or "green infrastructure," actually attempt to mimic natural hydrology by storing stormwater on-site, filtering it to remove pollutants, and in many cases infiltrating it into the groundwater below.

Examples of LID techniques vary greatly from conservation planning efforts that strive for minimal impervious surfaces on a site (e.g. shorter and / or shared driveways, minimal setbacks, narrower streets, and land preservation), to infrastructure designed to slow down and filter stormwater on site through the use of rain gardens, rain barrels, bio-retention systems, swales, and green roofs, among others. In retaining water on-site, LID techniques provide many benefits including reduced pollution and erosion of local waterways by handling "first flush" of rainwater; decreased combined sewer overflow (CSO) events; increased flow into groundwater, which can provide more stable flow in local waterways during dry periods; and in many cases decreased development costs and increased property values through enhanced aesthetics (Beggs and Perrin n.d.; MacMullan and Reich 2007).

Another critical benefit of LID is that it could be ideally suited to the non-point source nature of stormwater pollution by reducing stormwater impacts on small scales throughout an entire watershed. Newly developed sites could be compactly designed to incorporate narrower streets, minimum setbacks,

shared driveways, porous pavement, bio-swales, and green roofs. The portions of a watershed that have already been developed could utilize LID techniques that are easier to incorporate on a redeveloped or infill site, such as downspout diversions, rain gardens and rain barrels. While all of these practices could be theoretically employed to address polluted stormwater runoff, practically there is still considerable reluctance on the part of prospective users due to a general lack of understanding about LID techniques.

For example, if a survey were conducted of 100 people on the main street of any MS4 community in northern New England, asking them to describe why stormwater management is important, we would likely find a lack of understanding about the following: how stormwater runoff adversely affects the health of rivers and streams in their community; whether any streams in their community are on EPA's 303d list of impaired water bodies; what role they could play in improving the impaired water body; and, unless they are paying a stormwater user fee or utility fee – they likely have no idea what stormwater management is costing them in terms of tax dollars.

Since stormwater is a non-point source of pollution, this lack of understanding creates a major barrier to addressing effective management because the management needs to take place nearly everywhere we look, from the shopping mall and the post office, to the schoolyard and even our own backyards. If LID is not mandated via municipal ordinances and zoning, effectively managing non-point source water pollution via LID techniques will require that people understand the relationship between the way they live and how it is impacting the environment, along with how a degraded environment impacts them - either in their wallet or in terms of their quality of life (Ruckelshaus 2010).

While LID has its challenges, with legitimate concerns raised over homeowners and business owners ability to inspect and maintain the dispersed nature of LID infrastructure, and thus the potential added cost to municipalities for hiring an additional public works employee(s) and truck(s) to routinely inspect

LID projects throughout a community (England 2010) - numerous case studies of LID practices completed in the past 10 years by both state and federal governments have demonstrated that LID practices can be both environmentally effective and less costly than traditional stormwater management (US EPA 2007, Beggs and Perrin n.d.). Not only can LID techniques be installed in new development, but as previously mentioned, they can also be retrofitted into older developments to reduce stormwater runoff. For example, the city of Philadelphia is embarking on a 1.5 billion dollar eco-friendly LID style stormwater plan that the director of Philadelphia Water Department's Office of Watersheds says "creates jobs, beautifies the city and increases property values" (Baker, 2011).

Considering that studies by the EPA, The Center for Watershed Protection and others have shown that LID techniques can actually save developers money, why aren't we seeing more of these practices implemented in towns and cities across New England when new development projects are constructed or local public works and state highway departments re-grade and repave the highways and streets in our communities?

B. Barriers to LID

While some areas of the country have already invested heavily in low impact development techniques, such as the Puget Sound and Chesapeake Bay areas (Seattle Public Utilities n.d.; Alliance for Chesapeake Bay n.d.), LID is still relatively new in many parts of the country, including northern New England. As was found in a case study in 2008 by the Oregon State University Extension Service and Oregon Sea Grant, many are still unaware of LID, or they perceive LID practices as a potentially expensive and time-consuming risk (Goodwin et al, 2008). The Oregon case study brought together a focus group consisting of both local and state planners and engineers, developers, citizen planners, watershed council members and members from the National NEMO Network, (NEMO stands for

Nonpoint Education for Municipal Officials, an organization whose goal is to provide local officials with information, education and assistance on the latest in stormwater management and land use planning). The focus group organizers asked participants to discuss two questions: "What are the biggest issues and barriers confronting your ability to plan and implement future development while minimizing impacts to water resources?"; and "What education, training, or additional resources would help you address these issues, and to what audience(s) should these efforts be targeted?" According to the national representatives from NEMO, the findings of the Oregon case study were in line with their findings from other locations around the country. The strongest finding from the study was that local officials and developers did not understand the connection between today's land use development practices and the future financial and resource implications of those developments. The Oregon study found that the main obstacles to incorporating LID were both a lack of understanding as to what LID is and how it would impact development, as well as concern over the increased time and financial resources it would take to transition from conventional stormwater management to LID techniques and designs: "Participants…voiced concerns that local jurisdictions do not have the staff or funding to develop, revise, and enforce new codes or regulations, or to educate builders and developers on LID techniques"

The Oregon findings were echoed in Vermont, where the Chittenden County Regional Planning Commission conducted a 40-question survey about LID for the Vermont Department of Environmental Conservation (Senecal-Albrecht, 2010). Similar to the Oregon study, the survey was administered to both state and municipal staff, engineers, developers, and those involved with LID outreach. The survey focused on four types of barriers:

> *"…familiarity with and knowledge of LID; development process issues; physical constraints, and financial issues….The highest ranked perceived barriers to LID implementation in each of these four categories were:*
>
> 1) *developers and contractors have little direct experience with LID; 2) different or conflicting LID guidance from municipality vs. state; 3) poorly drained soils/low infiltration capacity; and 4) lack of documentation specific to the local area showing that LID is cheaper or at least competitive with traditional practices"*

Not surprisingly, these results are similar to findings in Maine. Don Witherill, Director of Maine's Department of Environmental Protection Stormwater Program, feels the state is progressing fairly well with LID techniques since the Chapter 500 stormwater regulations were established in 2005. His sense is that the biggest barriers to increased implementation are the lack of knowledge in the development community and the difficulty in promoting change (i.e., developers are being asked to do something different than what they have been doing for the past 25 plus years). Witherill also believes that some developers are actually pleased with stricter regulations because they understand that decreased road widths or smaller parking lots can save them money. However, another obstacle that exists at the local level is the competing interests between public safety and improved water quality. Many towns specify road widths to accommodate the maneuverability of excessively-sized public safety equipment. Unfortunately for streams and rivers, the increase in pavement required by local ordinances to provide unfettered emergency vehicle access often results in adverse impacts to aquatic health.

C. LID in Survey Communities

A series of questions from our survey focused on the implementation of LID (see Appendix A), with a goal of determining if any of the communities had overcome "lack of knowledge" and "fear of change" -- two of the biggest obstacles to LID implementation. Through our series of questions we hoped to discover: *Have they identified and addressed language in their codes and ordinances that are inconsistent with LID principles and practices? Has it been possible to foster "champions of LID" at the local level? Were there particularly effective educational materials available for local developers, planners and public works officials that could be shared with other communities in northern New England? Were there financial or development incentives in place that encouraged implementation of LID?*

The predominant theme we found throughout the three states is that LID still has not been widely adopted in any of the 11 survey communities, and is not required in any of them. But many are providing some form of leadership as posed in the questions above. We've summarized the findings into 5 categories: Successful LID Demonstration Projects; Incorporating LID in Codes and Ordinances; Fostering Local Champions of LID; Effective Educational Materials for Developers, Planners and Community Stakeholders; and finally, Providing Financial or Development Incentives Encouraging LID.

1. Successful LID Demonstration Projects

The importance of developing successful demonstration projects is a key component in providing proof to community members and developers that it can indeed work in the local climate and soils. While all the communities we interviewed were installing at least one or two demonstration LID projects, we will

highlight a particularly strong example in Bangor, Maine. Bangor is a great example of a community that has developed several demonstration projects in an effort to prove it is an effective alternative to conventional stormwater management. While the driving force behind LID in Bangor has come from the Maine DEP, the city has been working hard to incorporate LID practices in numerous projects around the community. The City's Environmental Coordinator, Wendy Warren, oversees much of Bangor's stormwater program. Her sense is that engineers still like the old way of getting water off site and that developers need to be educated about the cost effectiveness of LID. They also question whether LID will work with the soils in Bangor. As a way to promote LID in Bangor they have encouraged LID practices in the City's three watershed management plans. The city has implemented a half dozen LID projects with ARRA money as part of the Penjajawok and Birch Stream Watershed Management Plans. The projects vary from replacing impervious cover from an existing roadbed with porous pavement; constructing a bio-filter that treats stormwater from a parking lot; adding tree box filters to pedestrian areas and parking lots; and installing a floating island in an existing retention pond to promote more bacteria that can breakdown and consume pollutants in the water.

An important part of installing LID demonstration projects is publicizing the project, so developers and residents are aware of them. Bangor's LID projects are taking place at the highly visible Bangor Mall area, and at Eastern Maine Community College (EMCC). EMCC seems to be an excellent partner choice for LID demonstration projects because, as Warren notes, they are "ready to support and publicize the effort through their existing network of business and education connections." (Warren 2011). As part of Bangor's efforts they are spending an additional $10,000 on signage that will act as a self guided LID tour, educating residents on the BMPs installed in the city by graphically illustrating how each project works and explaining what the anticipated outcome will be.

2. LID in Codes and Ordinances

One of the often cited barriers of incorporating LID techniques into development plans is that, due to the innovative nature of the techniques, they can hold up the permitting process and thus delay development. Because standards in more traditional ordinances may conflict with LID in areas of minimum road widths, minimum set back requirements and certain curb and gutter conveyance designs, developers may need to get special permission to incorporate LID into a development.

While none of the surveyed communities require LID through development codes or ordinances, many of them are now encouraging it where possible. Portland has started to take the important step of identifying where their codes are inconsistent with LID with hopes of making changes to encourage LID over conventional development. The closest we found to requiring LID in an ordinance were the Stormwater Management Overlay district (SMO) and Bartlett Brook Watershed Protection Overlay (BBWPO) district in South Burlington. The site design requirements in the SMO district has maximum flow standards and suggests use of LID to be in compliance: "The post-construction peak runoff rate for the one-year, twenty-four hour (2.1 inch) rain event shall not exceed the existing peak runoff rate for the same storm event from the site under current conditions. Low Impact Development (LID) practices, including but not limited to practices detailed in the 'South Burlington Low Impact Development Guidance Manual', shall be incorporated into the site design as necessary to achieve the required runoff rate, and may be supplemented with structural measures, subject to the approval of the Stormwater Superintendent, to the extent necessary to achieve the required post-construction runoff rate."

According to Tom DiPietro, South Burlington's Stormwater Superintendent, the BBWPO district requires meeting such conservative post-development flow rates that LID tools and techniques are mandated by default. South Burlington has included LID on public and private property, including

porous asphalt, rain gardens and rain barrels. Their experience has been that flow rate reduction is better achieved through larger projects since rain barrel and rain gardens don't appear to be as effective at meeting the city's post-development flow rate requirements.

3. Champions of LID

A major barrier to LID implementation is the "fear of change" – trying something new. To overcome this problem it can be very helpful to have a trusted and credible advocate that is promoting the change from within. A key ingredient to spurring LID development in northern New England appears to be having a person, or a group of people, actively promoting LID project implementation as a means of addressing stormwater issues. Two striking examples from our 11 communities are Burlington, Vermont and Exeter, New Hampshire.

The stormwater manager for Burlington, Vermont, Megan Moir, has extensive background in LID based on experience gained in her previous work with the State of Vermont. As a Stormwater Scientist for the Vermont Department of Environmental Conservation, Moir advocated for LID in public presentations (Moir). Now, in her role in Burlington, she encourages developers to incorporate LID in their plans during the plan review process. Because the review process in Burlington, Vermont is triggered by development that is 400 SF or greater or more than one acre of impervious surface, Moir is reviewing even relatively small scale projects, and is always looking for appropriate opportunities to encourage LID techniques. Additionally, for the post-construction stormwater analysis, projects are required to evaluate the feasibility of mitigating existing/redeveloped impervious as well as new impervious.

In Exeter the champions of LID are the members of the Exeter Planning Board. Similar to Burlington, construction activities equal to or greater than one acre (or less than one acre if part of a larger common

plan of development) require review by the planning board. According to the Exeter Town Planner, Sylvia VonAulock, the town has a highly active planning board that was open to environmental planning. The board has taken advantage of the educational resources at the nearby Great Bay Discovery Center in Greenland, New Hampshire to become local experts on LID, "drilling developers on what they are using for LID" and if LID is not in their plans they ask why not. It also helps that one of the town's two third-party reviewers for development plans is the local Soil and Water Conservation District, who is also very supportive of the innovative LID techniques.

4. Effective Educational Materials

While our research focused specifically on the MS4 communities, some of the biggest proponents of LID in all three states appear to be the non-profits, (state NEMO coordinators, environmental organizations such as the Casco Bay Estuary Partnership, and the UNH Stormwater Center) and state and county government, as can be seen with the development of the "LID Manual for Maine Communities" by the Maine Department of Environmental Projection and the "Vermont Low Impact Development Guide for Small and Residential Sites" by the Vermont Department of Environmental Conservation.

While these manuals are extensive, with detailed drawings that explain how to construct LID and how they work, it is possible that having specific information on design and construction of LID techniques coming from a local agency may help allay developer's fears that it won't work or isn't accepted in a particular municipality. For a developer or homeowner to voluntarily pursue LID techniques in their development, they would likely need to have a complete understanding of the costs and benefits of LID and a comfort level that it will work on their particular site.

With funding help by non-profits and state organizations, some municipalities are starting to develop their own local resources. Two particularly strong examples are visible in South Portland and South Burlington. With financial help in the form of a $23,000 grant from the Casco Bay Estuary Partnership, South Portland was able to develop a stormwater manual that includes a large section on LID practices and planning techniques. This manual has been put up on their website with the hope it will be utilized by municipal officials (planners, code enforcement officers, planning board and conservation commission members, and municipal stormwater program managers) as well as developers and individual property owners (South Portland, Manual).

As previously mentioned, South Burlington also has its own Low Impact Development Guidance Manual designed for developers, designers, and business owners as well as homeowners. Utilizing funds from a US EPA National Integrated Water Resource Demonstration Grant, the South Burlington manual details conservation design practices, filtration practices, infiltration practices, landscaping practices and runoff conveyance practices.

Because all of the MS4 communities are required to comply with and annually report on EPA's six minimum control measures, there is incentive for communities to educate their residents about LID. As part of minimum control measure one (Public Education and Outreach) and minimum control measure two (Public Participation and Involvement) there is certainly material that could be used to engage the public with events such as a rain garden planting in Portland's Back Cove and the installation of LID self guided tours in Bangor. Based on responses to our survey questions, Portsmouth seemed the most active in educating the public about LID, with programs to promote use of rain barrels and rain gardens, developing a brochure and other PSA materials focusing on LID, and conducting educational and outreach activities with local schools.

5. Providing Financial or Development Incentives Encouraging LID

Developers who are incorporating innovative strategies for addressing stormwater often face delays in permitting process times, which can cost developers money. Expediting the permitting process, providing development density bonuses, or reducing impact fees, application fees or development fees are several strategies that have been suggested to encourage more LID development within a community (NAHB). There was little evidence of municipalities providing financial or development incentives to spur LID development within our 11 survey communities, with the exception of Dover, providing incentives in their zoning ordinance for cluster development, and communities that have Stormwater Utilities or User Fees that offer discounts for reductions in imperviousness. Lewiston, which manages a stormwater utility, provides a reduction in the stormwater utility rate for commercial properties with on-site stormwater management. Burlington also provides a stormwater user fee credit to properties that reduce volume or improve the quality of water leaving their site. "The degree of credit shall be based on the degree of reduction in stormwater runoff volume and/or the degree of water quality improvement of stormwater runoff." (Burlington, Vermont, 2009, May).

For smaller LID techniques, such as rain barrels, many cities in New England provide rain barrels at discounted prices, but Portsmouth is the only one of our survey communities who appears to be offering this incentive. One innovative technique for incentivizing rain barrel implementation that seemed relatively innovative is taking place in Cincinnati, Ohio, where the city utilizes a reverse auction for rain barrel implementation. They have found that "a reverse auction mechanism is a more cost-effective way of identifying and securing the adoption of stormwater management practices on those residential parcels that will provide the greatest level of ecological benefit per program dollar spent (Thurston et al).

D. Implications of LID as a Tool for Addressing Stormwater

As has been seen in Northern New England's most proactive MS4 communities, there are still many barriers to implementing LID. Unless mandated, there needs to be more education and incentives to encourage developers and homeowners to install/incorporate LID on site. Once installed there is still the hurdle of making sure that it has been properly installed and is maintained over time, otherwise it doesn't help reduce stormwater – resulting in municipalities that still have impaired waters.

As was shown in one of our survey questions, monitoring of current BMP's and LID techniques is spotty at best. Some cities are moving in the direction of having a dedicated staff person to routinely check on BMPs/LID and are anticipating costs of hiring additional staff to inspect LID projects, utilizing funds from a stormwater utility or stormwater fees. But ultimately one of the biggest takeaways for communities that are not fully developed is to take the time to incorporate stronger stormwater protection ordinances as soon as possible, before more sprawling development contributes to water pollution in their community. A study in Ipswich, Massachusetts used actual field measurements in the same watershed to compare the stormwater performance of 3 different development scenarios against a non-developed site (Fitsik 2010). Using EPA's Stormwater Management Model software (SWMM), they took stormwater measurements in a 38 acre parcel of undeveloped land, a 38 acre Open Space Residential Design (OSRD) of 20 clustered homes that used LID stormwater management techniques and modeled their performance against the same OSRD development *without* LID techniques (using conventional curb and storm drain system) and a conventional subdivision consisting of thirty-eight 1 acre lot sizes. The OSRD development consisted of 20 single family homes on 0.20 acre lots with 20 foot setbacks, shorter driveways and narrower streets (18 feet) while the conventional subdivision that was modeled had 50 foot setbacks, 24 foot road widths and rooftops that drained via a gutter system.

The study found that of the three developed scenarios, the OSRD with LID techniques came closest to mimicking the undeveloped 38 acres, while the OSRD without LID techniques came in a close second and the traditional development came in a distant third. The moral of the story is that the zoning of clustered homes with shorter setbacks, shorter driveways and narrower streets had a significant impact on reducing stormwater runoff, with the LID techniques providing a minimal additional boost, proving it makes most sense from a stormwater management perspective to focus on development strategies first and then look to LID for added benefit. While this strategy won't help the built up communities in Northern New England, such as Portland or Burlington, it could be very helpful to the more rural communities that are still developing.

VI. MUNICIPAL STORMWATER MANAGEMENT PROGRAM FINANCING

A. Overview

Stormwater management is becoming increasingly expensive. EPA released the Phase II Stormwater Permit Rules in 1999 (for small MS4s) and estimated the cost to implement the program nationally at nearly one trillion dollars (EPA, 1999). Indeed, stormwater management has evolved dramatically over the past several decades from being focused primarily on flood control to addressing a myriad of water resource protection considerations through federal, state and local environmental regulations. The primary driver for these changes is the simple fact that so many of the nation's surface waters still fail to meet water quality standards, largely due to polluted stormwater runoff (NRC, 2008).

This evolutionary process is requiring municipalities to adapt their stormwater management programs to meet increasingly stringent regulatory requirements. The changes are affecting virtually every aspect of municipal stormwater program management, from planning, design and construction to operation and maintenance (NAFSMA, 2006). Perhaps most importantly, many municipalities are finding that stormwater program financing must also adapt to the changing regulatory landscape since it supports all of the associated activities needed for regulatory compliance.

The cost of complying with stormwater regulations are likely to increase significantly in the near future. EPA is currently proposing to strengthen federal stormwater rules to include new provisions that:

- Expand the areas subject to federal stormwater regulations
- Establish specific requirements to control stormwater discharges from new development and redevelopment
- Develop a single set of consistent stormwater requirements for all MS4s

- Require MS4s to address stormwater discharges in areas of existing development through retrofitting the sewer system or drainage area with improved stormwater control measures (this includes addressing the water quality impairment issues associated with Combined Sewer Overflows)[15]

- Explore specific stormwater provisions to protect sensitive areas

As part of this process, EPA will attempt to identify the current capacity of municipal budgets for their existing programs while also estimating the financial impact that could result from the proposed new rules (Federal Register, 2009). The eventual outcome of EPA's proposal to strengthen federal stormwater rules is uncertain. However, if MS4 communities are ultimately required to do even more to address polluted stormwater runoff, then municipal stormwater program costs will surely increase. Consequently, stormwater managers will be under even greater pressure to carefully evaluate all aspects of their programs to demonstrate "a reasonable expectation of success before committing resources toward specific activities (CASQA, 2005, p. 1)." Defining what success means in this context is a critical but separate issue to be explored later.

B. Municipal Stormwater Program Cost Components

In correspondence with the increasing costs of small MS4 programs, the complexity of stormwater program management has also increased dramatically in recent years. Moreover, stormwater program management "has evolved from a basic capital construction and maintenance program supported primarily by local taxes, to a program of integrated water resource management, environmental

[15] Nationally, CSO program funding has been considered separately from stormwater management program funding. However, given the magnitude of the costs associated with CSOs and the fact that a significant proportion of CSO pollution can be directly attributed to stormwater runoff, many municipalities are beginning to consider allocating some of their CSO program costs to stormwater management programs. This complex subject is beyond the scope of the research questions considered here.

enhancement, and recreational services requiring a multi-faceted benefit based finance system (NAFSMA, 2006, p. ES-1).” In addition to basic operation and maintenance for existing infrastructure and equipment, all municipal stormwater management programs must now also include the six basic Minimum Control Measures as required by Phase II stormwater regulations. Each one of the MCMs involves a host of associated BMPs that must be implemented to comply with federal stormwater rules.

Additionally, the Clean Water Act requires municipalities with surface waters that fail to meet state or federal water quality standards to develop TMDLs which provide general restoration recommendations for reducing pollutant loadings so impaired waters can meet applicable water quality standards. Many communities with impaired waters also opt to develop WMPs. They do so because WMPs generally provide a much more specific set of restoration recommendations than TMDLs while also establishing an implementation schedule, pollutant load reduction goals, a means to measure progress towards achieving these goals and potential funding sources. Perhaps even more importantly, municipalities with EPA-approved WMPs are eligible for federal grant funding to help restore impaired waters.

It is fairly common for Phase II MS4 communities to have impaired waters within their municipal boundaries. Consequently, developing these tools can represent a considerable expense above and beyond Phase II stormwater permit requirements. And while the pollutant load reductions specified in TMDLs have thus far been largely unenforced, it seems likely that regulatory or legal mechanisms will oblige municipalities to seriously address and reduce pollutant inputs to their impaired waters (Owen, 2010). Since impairments to degraded surface waters often originate from sources closely linked to polluted runoff, the fiscal impacts of this obligation on small MS4 programs could be considerable.

Addressing discharges from combined sewer overflows to surface waters is another large and looming expense that many municipalities may soon be required to bear. CSOs release untreated sewage when

stormwater drains and sewer lines combined in the same piping system are hydraulically overloaded during heavy rainstorms. These discharges are directly related to stormwater and there are many communities throughout the country that have already allocated a certain proportion of CSO costs to their stormwater management programs (Reese, 2011). The City of Portland, ME is one such community currently considering funding a portion of $170M in EPA-mandated CSO abatement work through a stormwater utility fee (Murphy, 2011). Depending on the outcome of these deliberations, the City's stormwater program costs could increase very significantly and the sewer rates which currently fund all of the CSO program costs would be virtually guaranteed to increase by at least a factor of 3.

In summary, the recently proposed changes to Phase II regulations are likely to drive municipal stormwater program O&M and capital replacement costs higher. And for MS4 communities with impaired waters and CSOs as added cost drivers, municipal stormwater program management is likely to become even more expensive. The extent to which small MS4 communities account for these costs in their budgets presents a very real challenge for municipal stormwater program managers.

1. Identifying Municipal Stormwater Management Program Funding Needs

To prepare for potential increases in future stormwater program costs, it will be crucial for small MS4 communities to accurately identify current stormwater program costs. In addition to accounting for annual operation and maintenance expenses, stormwater program budgets should also include capital replacement for equipment and infrastructure. In particular, small MS4 communities that fund their programs through property taxes often defer capital improvements for stormwater projects given the stiff competition for general revenue funds from higher profile municipal budget needs (NEEFC, 2005). For example, retaining a teacher's position or purchasing a new ambulance can often seem much more pressing and justified than replacing a section of deteriorating storm drain (until the pipe fails and

flooding occurs). Moreover, establishing a thorough understanding of funding adequacy for current stormwater program components is essential in attempting to identify the potential funding gap for any proposed new stormwater program components.

Despite the urgent need to clearly understand stormwater program costs, many small MS4 communities struggle to do so. The Interlocal Stormwater Working Group (ISWG) also closely monitors regulatory developments at the state and federal levels. Current efforts by EPA to strengthen stormwater regulations have caused considerable concern among ISWG member communities because of the likelihood that municipal stormwater program costs will increase if the proposed rules are implemented.

While the ISWG intends to submit comments in response to the proposed rules, it may be problematic to make the case for fiscal impacts to municipal budgets since most communities do not have a comprehensive understanding of their current stormwater program costs. Aside from Portland and South Portland, most of the ISWG member communities do not have staff dedicated solely to stormwater program management. These smaller communities generally rely on public works directors to manage their stormwater programs and with all of their other responsibilities it has been very difficult to develop separate stormwater program budgets. In most cases, stormwater program costs are combined with other municipal budget items. And even for Portland and South Portland, which have Stormwater Program Coordinators, it has been difficult to separately identify stormwater program costs given the intertwining of program functions within the municipal budget.

For example, public works departments often perform street sweeping and planning departments often provide development review for proposed new drainage infrastructure. While both of these activities are directly related to stormwater management, they are typically not included in the stormwater program budget. Another example involves TMDLs (and the WMPs often developed to supplement TMDL

recommendations). Environmental regulators are increasingly linking water quality impairment with urban stormwater runoff. In Maine, the Department of Environmental Protection (DEP) has developed a state-wide Impervious Cover TMDL that uses the amount of impervious surfaces[16] in an impaired watershed as a surrogate for the suite of adverse impacts to local water resources commonly associated with urban landscapes (VTDEP, 2011). Vermont has developed TMDLs that use runoff volume as a surrogate for stressors associated with stormwater (VTDEC). Again, while stormwater is the primary driver necessitating the development of these TMDLs, the cost to comply with them is generally not borne specifically by municipal stormwater management programs.

2. Municipal Stormwater Management Program Funding Options

Given the numerous expenses associated with municipal stormwater program management and likelihood these costs will continue to increase due to more stringent regulations, the establishment of stable and sustainable funding sources is and will continue to be of paramount importance for small MS4 communities. Differences between the two major types of funding options - taxes and fees – are often perceived as subtle or nonexistent. However, there are important legal distinctions. Taxes are imposed to generally support the various functions of local government whereas fees are charged for particular governmental services that benefit the parties paying the fee. Therefore, unlike taxes fees may sometimes be voluntary in that they do not have to be paid if the governmental services being offered are not used (e.g., an undeveloped property may not have to pay a stormwater fee based on impervious cover). Finally, fees are intended to recoup the actual cost of the governmental services being provided (NAFSMA, 2006). There are numerous options available to municipalities for stormwater program funding. Some of the most common are summarized in Table 2.

[16] Impervious surfaces prevent or impede precipitation or snow melt from soaking into the ground. Examples include pavement, roof tops, sidewalks, etc. There is a strong correlation between the amount of impervious surface in a watershed and adverse impacts to aquatic habitats.

Table 2: Summary of stormwater funding methods and mechanisms (NAFSMA, 2006)

Funding Type	Advantages	Disadvantages
General Fund / Property Taxes (most common)	• Not much technical analysis needed • Funding sources well-established and easily understood • Generally well accepted by citizens and local businesses	• Dispersed functions between municipal departments obscures relationship between stormwater services and cost allocations • Usually does not compete well against other municipal funding priorities • Little or no association with stormwater program needs • "Free ride" for tax exempt properties • Poor relationship between tax bills and stormwater impacts
Stormwater User Fee (increasingly common)	• User fee funding similar to other municipal utilities (e.g., water & sewer) • Flexibility in structuring fees • Close linkage between fees and stormwater impacts (i.e., impervious area) • Stable, dedicated revenue stream	• High visibility of fee and cost of implementing billing system • Public perception of an additional tax (e.g., "rain tax")
Plan Review, Development Inspection & Special User Fees	• Usually associated with and perceived as protecting public health & welfare • Can be targeted to specific properties & activities thus relieving general taxpayers of added expense (equitable)	• Typically provides small amount of revenue for stormwater utility • May require review of other regulations and fees to avoid double charging
Special Assessments	• Costs allocated in proportion to benefits received by specific properties	• Sometimes difficult to define and economically measure benefits • Generally cannot be broadly applied to all properties for stormwater improvements • Must conform to more restrictive cost allocation standards than SW utilities
Capital Improvements Bonding	• Allows expenditures that far exceeds current revenues & resources • Expedites construction process & potentially reduces (or eliminates) future expenses	• Incurs interest expense thereby increasing total project cost

Other less significant or less commonly used funding mechanisms include (NAFSMA, 2006):

- ***In-lieu of construction fees*** are charged in lieu of requiring construction for on-site stormwater systems
- ***Capitalization recovery fees*** recover a fair share of the prior public investment in infrastructure capacity installed to accommodate future development
- ***Impact fees*** mitigate costs of development impacts for individual developments by building public off-site improvements where impacts can't be addressed on-site
- ***Developer extension / latecomer fees*** are not an actual revenue mechanism, but instead a way to allocate capital costs among properties as they are developed
- ***Federal / state grants, loans, and cooperative programs*** are usually one time funding sources. More common examples include EPA Clean Water Act grants ("319" grants), state revolving loan funds and collaboration with natural resource conservation agencies (e.g., soil and water conservation districts, state cooperative extension offices, etc.)

Accurately identifying current and anticipated future stormwater program needs is a necessary prerequisite for determining which funding options are most appropriate for any MS4 program. The next section discusses the various funding mechanisms employed by some of the more prominent MS4 programs in northern New England and examines the extent to which they have been able to establish current and expected stormwater program costs.

C. Questionnaire Results

1. How MS4 Communities in Northern New England Pay for Stormwater Management

The eleven regulated MS4 communities participating in this study rely on three major methods to cover the costs of their stormwater management programs (Figure 5). The use of the General Fund was the most common with five communities fully relying on it to pay for stormwater program costs; three communities utilize sewer user fees while three rely on stormwater utilities. The majority of MS4s use revenues from the General Fund for reasons ranging from historical precedent (because it's always been done this way) to anticipated public resistance for another method that might be perceived as a "rain tax" (such as a stormwater utility). This finding is somewhat inconsistent with national trends which indicate an increasing use of stormwater utilities in other parts of the country (USM EFC, 2005).

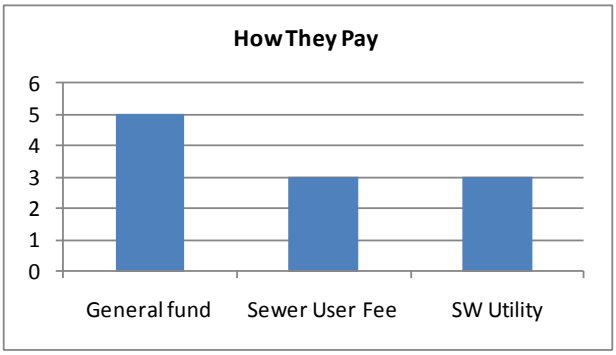

Figure 5: how study participants currently fund their stormwater programs

Somewhat surprisingly, discussions of reliance on sewer user fees to cover stormwater program costs are largely absent from most of the literature even though three study participants – all of which represent major metropolitan areas – currently use this method. The primary rationale for this arrangement derives from the extensive experience that sewer and wastewater departments have with the NPDES regulatory framework to meet compliance requirements for CSO's and wastewater effluent discharges. Therefore, when the NPDES Phase II permit rules for small MS4s became effective in 2003, some regulated communities decided to delegate stormwater management responsibilities to sewer and / or wastewater divisions. In fact, the City of South Portland changed the name of its Water Pollution

Abatement Department to Water Resource Protection to reflect this broader mission and expanded responsibilities.

The three remaining communities using stormwater utilities to pay for stormwater programs all transitioned from other financing methods in the fairly recent past. The key justification for these shifts in funding strategies was to generate more revenue to more effectively meet increasing stormwater program needs and expenses. Common examples of increasing cost-drivers offered by study participants include TMDLs, the development of WMPs, CSO separation, and the replacement of aging equipment and infrastructure. Additional reasons for adopting a stormwater utility include fairness and equity (since user charges proportionally reflect the actual cost of providing services) and the ability to establish a more stable and predictable revenue source.

2. Adequacy of Current Funding Sources

The responses of study participants to questions about the adequacy of available funding sources to meet current stormwater management program needs were also largely consistent with the literature. Seven MS4 communities believe they do not currently generate enough revenue to adequately fund their annual operations and maintenance (O&M) program needs while one is uncertain (due primarily to difficulties in accurately identifying stormwater program costs). Three MS4s are confident that enough revenue is generated to adequately pay for current O&M costs (Figure 6).

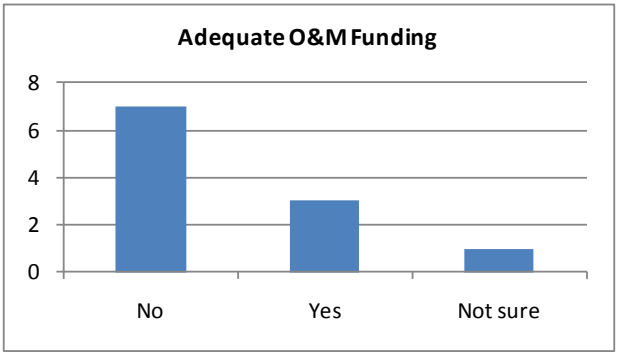

Figure 6: study participants that believe funding is adequate to meet annual O&M needs

The responses were similar for capital improvement program (CIP) needs (Figure 7). Six communities do not generate enough revenue to adequately fund their CIP budget, four are unsure (again, due to not having fully identified stormwater program costs), and one believed funding is currently sufficient but will likely be inadequate based on future stormwater regulations.

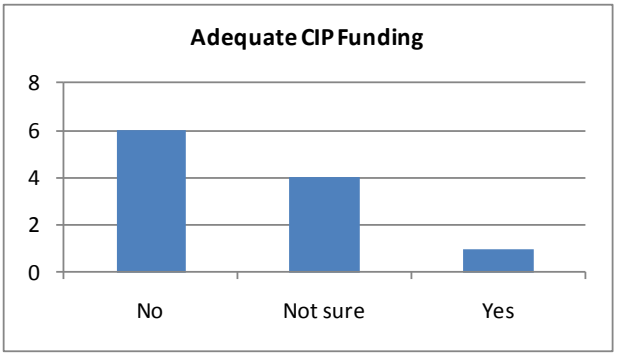

Figure 7: study participants that believe current funding is adequate to meet CIP needs

Perhaps the most telling finding from this grouping of questions is the extent to which study participants have been able to estimate the funding gap between how much revenue their stormwater programs generate and how much funding they need (Figure 8). Eight MS4s have not been able to establish how much additional revenue is needed to close this funding gap.

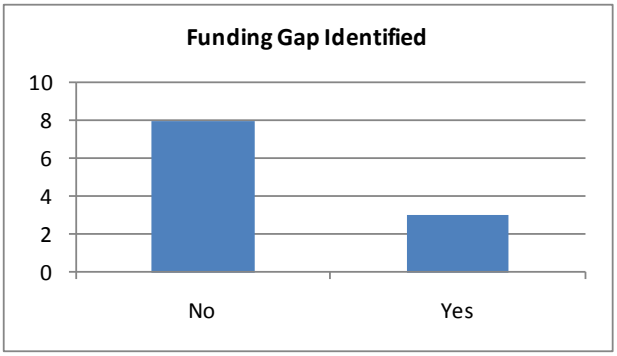

Figure 8: study participants that have identified funding gap between current stormwater program revenue and actual budgetary needs

And of the three that have been able to at least estimate the funding gap, two express reservations about being able to do so in the future given uncertainties about changes in stormwater regulations.

3. Identifying Future Stormwater Management Program Funding Options and Needs

Given the inherent ambiguity of future stormwater regulations, most study participants are either actively pursuing or will soon begin considering alternative or additional funding options for their stormwater

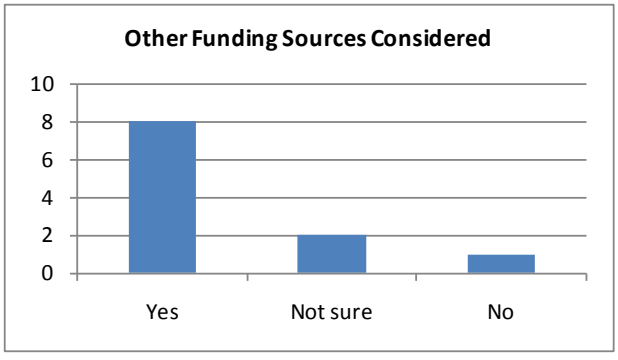

Figure 9: study participants considering alternative or additional funding sources for stormwater programs

management programs (Figure 9). Eight MS4 communities have or likely will explore either completely changing or supplementing their current stormwater financing method (two of these already have dedicated funds from stormwater utilities). This could entail a dramatic change, such as foregoing the use of the general fund in lieu of a stormwater utility to pay for stormwater programs. It could also be much more modest, such as periodically applying for grants to help meet stormwater program needs (for example to help develop WMPs). However, six of the study participants currently are seriously considering (or likely will consider) transitioning to a stormwater utility funding method.

Given the difficulties many study participants have had in identifying stormwater program funding gaps, most are now actively working to develop a comprehensive understanding of their infrastructure so they can be better prepared to meet future stormwater program needs (Figure 10). Six study participants are expending considerable time and effort on infrastructure mapping and populating their geographic information systems (GIS) with meaningful and relevant attribute data. Four study participants already have well developed GIS programs that they believe can be used to help identify future stormwater program needs (though in most cases they have yet to begin this process). One study participant has not yet been able to develop the GIS capabilities sufficiently to assist in identifying future stormwater program needs.

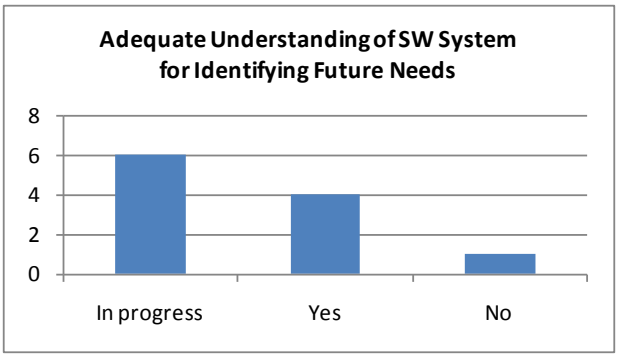

Figure 10: study participants with adequate stormwater system understanding for identifying future stormwater program needs.

Six study participants have either established or are developing a prioritization process to identify future stormwater program needs (Figure 11). A few MS4 communities are integrating their GIS data with an asset management system that will provide a powerful prioritization tool for helping to identify future

stormwater program needs. In some cases these systems have predictive capabilities that will allow stormwater program managers to make better informed decisions about which stormwater equipment or infrastructure to replace based on the susceptibility to failure. Three study participants have not yet developed a prioritization process while two are not sure whether existing stormwater system data is adequate enough to begin this process.

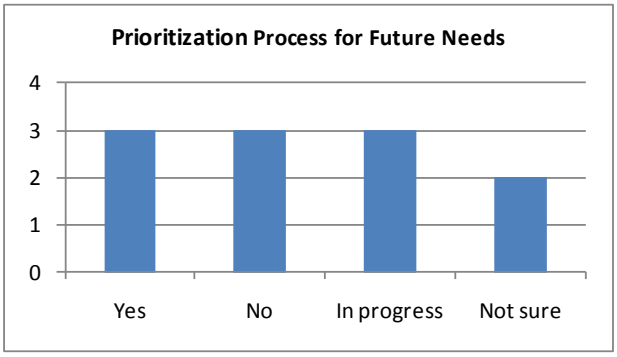

Figure 11: study participants with prioritization processes for identifying future stormwater program needs

D. Implications

Managing stormwater in MS4 communities can be expensive and is very likely to become more so in the near future. This is due in large part (or wholly) to the evolution of stormwater regulations from basic flood control considerations to a much more sophisticated, multifaceted and complex body of associated laws. MCMs, TMDLs, WMPs and CSOs all form a veritable alphabet soup within which unwitting stormwater program managers can easily become overwhelmed. Given this reality, MS4 communities will need to have a clear understanding of stormwater program costs in order to meet the growing demands imposed by more stringent stormwater rules.

Responses to the questions on stormwater program financing clearly indicate that most of the study participants believe current revenues are not adequate to cover current O&M and CIP funding needs. Moreover, most stormwater program managers in the study expressed considerable concern about the ability of their current financing strategies to meet future O&M and CIP funding needs – especially given the uncertainty of impending changes to state and federal stormwater rules.

Fortunately, most MS4 communities in the study are actively working to develop a much better understanding of stormwater program cost components and potential alternative funding strategies – and with very good reason. The costs of inaction, while difficult to predict with any precision, are very likely to be considerable. MS4 communities failing to adequately prepare financially for future state and federal stormwater permit requirements face a variety of potential consequences, such as:

- Damage to public infrastructure and private property from increased flooding
- Continued water quality degradation (including drinking water supplies)
- Regulatory / legal liability (TMDLs, CWA, third party lawsuits, etc.)
- Loss of ecosystem services
- Loss or ecotourism revenues

The following excerpt from a stormwater utility feasibility assessment for Dover NH, one of the MS4 communities in the study, typifies this dilemma.

> *Stormwater program management and funding are currently decentralized, and are implemented and funded through multiple mechanisms. The City's stormwater discharges are subject to the National Pollutant Discharge Elimination System (NPDES) program, which is administered by the Environmental Protection Agency (EPA). Key changes between the existing permit and the proposed draft permit are expected to significantly increase the staffing and funding resources necessary to maintain permit compliance in future years. The City is in need of a defensible, stable, and equitable approach to funding the stormwater program.*

Municipal Stormwater Utility Feasibility Study, City of Dover, NH (Dec. 2010)

It now appears that for most small MS4 communities the rules of engagement for stormwater program management will soon become much more involved and complex. This increasing complexity will come with associated costs that require stable and steady funding sources. Stormwater regulated communities that fail to recognize and heed this new reality do so at their peril.

VII. FINAL CONCLUSIONS & POTENTIAL IMPLICATIONS

As clearly indicated by the preceding discussion, stormwater management is an evolving and increasingly complex subject that spans many disciplines and involves a wide variety of expertise. The questionnaire developed for this research effort was intended to identify some of the most relevant concerns and considerations from the unique perspectives of the public officials directly involved with municipal stormwater management programs. This effort was largely successful based on the candid responses and thoughtful insights of the municipal staff from the communities participating in the study. Our research team learned a great deal from their individual and collective experiences.

Not surprisingly, we also discovered that responses to particular questions often depended on the professional perspectives of the respondents, and perhaps even more importantly which municipal staff

members were able to participate in the interviews. For example, planners might have only a cursory understanding of stormwater system maintenance practices while Public Works Directors might have only a passing knowledge of the development review process. Consequently, there may be an occasional gap in some of our data collection when not all members of the stormwater program management team were present for the interviews. Even so, the overall interview results and corresponding research yielded a number of very compelling conclusions, the more salient of which are summarized below.

<u>Motivations for Developing Stormwater Programs</u>

- The primary driving force behind developing and implementing stormwater management programs was Phase II MS4 permit regulations.
- Absent specific detailed guidance that links MS4 permit requirements to actual water quality improvements, municipalities are likely to continue to focusing on MCM implementation and

will only engage in watershed planning to fend off potential enforcement actions or legal challenges (such as those initiated in Long Creek).

- Many residents, developers, municipal staff and elected officials have a poor understanding of the water resource problems associated with polluted stormwater runoff. Moreover, there is an inherent inertia in addressing these problems given their complexity and considerable cost.

Local Planning for Water Quality Protection

- Contrary to concerns that stormwater regulations necessarily promote sprawl, there is a growing body of empirical research that firmly establishes the connection between smart growth approaches and local water resource protection through effective stormwater regulation.
- Planners have a crucial role to play in mediating the relationship between density and water resource protection since where and how development occurs directly affects the extent to which receiving waters will be adversely impacted by stormwater runoff from surrounding land uses.

Watershed-Based Planning for Water Quality Protection

- For municipalities struggling with a host of competing priorities, stormwater management often is assigned a low priority in relation to other budgetary needs or capital expenses. This relative disregard is exacerbated by the fact that addressing water quality issues is quite costly and often perceived as hampering economic development – particularly during periods of recession.
- The lack of specificity in TMDL restoration recommendations and the lack of funding available for WMP development place the burden of determining pollution sources and developing restoration plans squarely on the municipalities with impaired waters.

- The CWA goal of restoring impaired waters is not being met. Therefore, greater consideration should be given to evaluating the environmental, social and economic benefits and costs of achieving water quality goals in an urban setting.

On Site Stormwater Treatment (LID)

- Many barriers remain for implementing LID. Unless mandated through state or local regulations, there needs to be more education and incentives to encourage developers and homeowners to install/incorporate LID into new development or redevelopment projects at the site level.
- Proper design, installation and long-term maintenance are critical considerations when contemplating the use of LID practices. There are numerous ways to implement LID practices incorrectly but only a few ways to do them correctly (i.e., so that they function as intended).
- Communities with land available for new development have the best opportunities to employ LID practices in ways that will both protect water quality and reduce overall stormwater management costs.

Financing for MS4 Programs

- Most stormwater program managers in the study expressed considerable concern about the ability of their current financing strategies to meet future O&M and CIP funding needs – especially given the uncertainty of impending changes to state and federal stormwater rules.
- Stormwater program management will likely become more expensive so that MS4 communities will increasingly need to consider alternate and sustainable funding sources.

- The actual costs of MS4 stormwater program management will need to be better identified and understood to enable adequate planning and preparation for future stormwater program needs and requirements.

Potential Implications

The conclusion with one of the most significant implications is the relatively poor understanding many municipal officials and state / federal regulators have of how or whether MS4 program activities result in appreciable improvements to water quality. Despite the use of a variety of local, state and federal regulatory mechanisms for nearly a decade (more for Phase I communities), most impaired surface waters continue to violate water quality standards. Consequently, it appears that current strategies are not working and new approaches to watershed restoration are needed.

One notable and promising approach that originated from the California Stormwater Quality Association (CASQA) is to use measureable outcomes for evaluating and periodically modifying municipal stormwater management programs. Conceptually, this involves using a progression of six "outcome levels" to establish a coherent and consistent methodology for evaluating stormwater program effectiveness (Figure 12). All outcome levels are mutually supportive and provide a rational basis for making sound management decisions to achieve the overall objective of water quality protection and restoration. EPA has adopted this approach and developed technical guidance documents for it. However, it remains to be seen whether any aspects of it will be incorporated into their proposed stormwater rules.

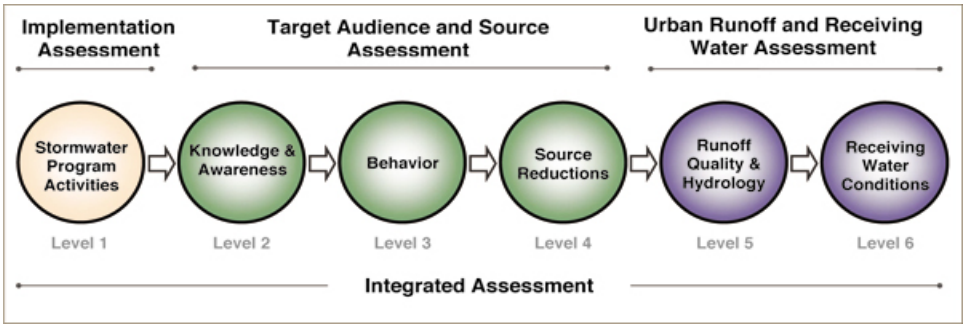

Figure 12: Outcome level assessment methodology for measuring stormwater management program effectiveness

The "denser is greener" conclusion also has profound implications since it represents how and where new development and redevelopment will occur. It also refutes the ostensible conflict between stormwater regulations and smart growth. In fact, there is convergence of interests for the proponents of smart growth and LID practices since both seek to accomplish the similar goal of combating sprawl, or as one astute observer put it, "LID may be neutral on growth, but there is no excuse for LID to remain neutral on sprawl (Drieling, 2010)." Since sprawl is largely a consequence of local land use regulations (particularly in northern New England), municipal planners have a crucial role to play in promoting the use of smart growth approaches and LID practices. In addition to watershed-based zoning, several innovative tools have been established to guide development for water quality protection. Examples include in-lieu fees, utility / impact fees for development transfer program and land banks – all of which provide the additional benefits of identifying and protecting other significant natural resources.

Intelligent development design is also a unifying concept for smart growth and LID since both seek to use smaller amounts of land as efficiently as possible. Moreover, designing new compact developments with integrated LID practices can significantly reduce adverse impacts to water quality while also reducing overall construction costs. Numerous studies have established that compact developments produce much less stormwater runoff volume (and pollutant load) than their more conventional counterparts when measured at a watershed scale – even though impervious cover is considerably

greater at the site scale (Figure 13). In new developments, green infrastructure often obviates the need for more costly "grey infrastructure" (e.g., conventional piped storm drain systems with a series of catch basins). Given appropriate site conditions, the same may even be true for some redevelopment / retrofit projects (e.g., porous asphalt can be considerably less expensive than conventional piped systems). In support of these obvious benefits, EPA is now considering mandating the use of green infrastructure / LID in its proposed stormwater rule revisions.

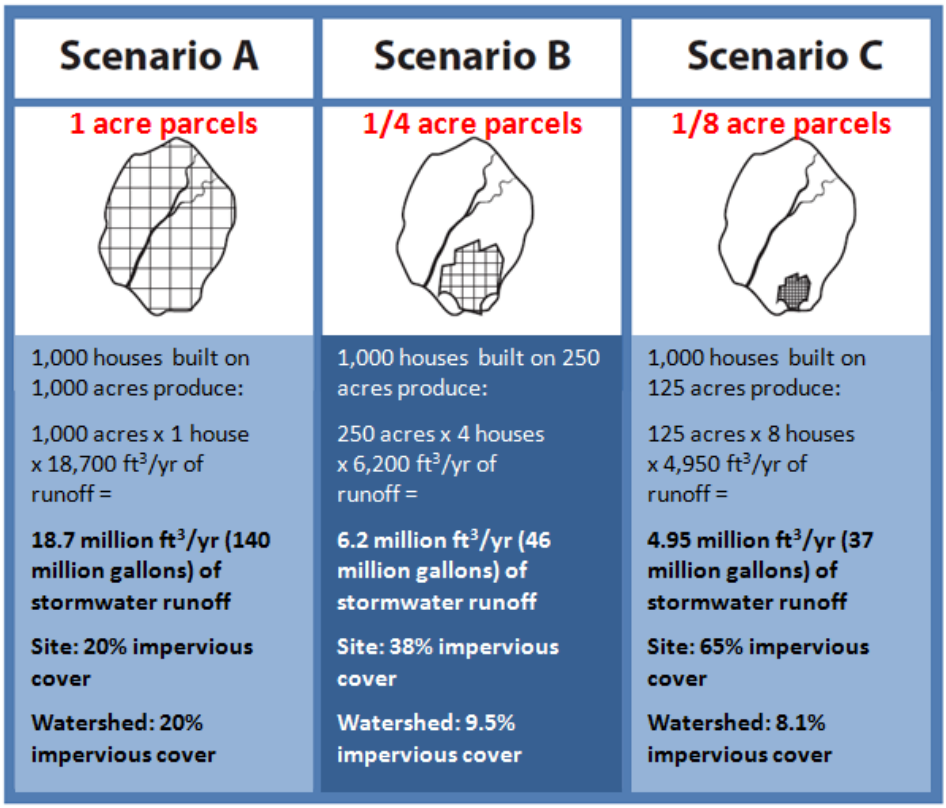

Figure 13: Stormwater runoff volume comparisons for different development density scenarios

Finally, since paying for municipal stormwater management programs is becoming increasingly expensive, it will be critical for MS4 communities to have a thorough understanding of their stormwater program cost components. Pushing back against "unfunded mandates" in proposed stormwater regulations or requesting additional funds from cash-strapped municipal governing bodies to meet watershed restoration requirements will demand an accurate and complete accounting of stormwater

program budgets. The need for accurate accounting appears even more urgent given that many of the study communities did not have a firm grasp on all of the expenses associated with their stormwater management programs, such as street sweeping, development review, program administration, etc. For the expenses that stormwater program managers could clearly identify, most believed that current revenues were insufficient to meet existing capital replacement (and in some cases O&M) funding needs.

There are strategies MS4 communities can use to contain some of the costs associated with their stormwater programs. Examples include promoting intelligent development design (e.g., compact near existing utilities with reduced or reused impervious area and integrated green infrastructure); sharing material assets and resources between MS4 communities; and forming or participating in interlocal groups to meet MS4 permit requirements and to more effectively influence the outcomes of stormwater rule making. However, even with all these cost-reducing strategies the sobering reality is that stormwater program costs will almost inevitably continue to rise. All of the study participants acknowledged this fundamental truth and most were actively preparing for it by exploring alternative and sustainable funding methods – primarily in the form of stormwater utilities (which is beyond the scope of this research).

It is possible to imagine a future for which MS4 program costs would not increase or perhaps could even *decrease* (i.e., due to the abolition of EPA following the 2012 Presidential elections). However, the more likely scenario might be some form of incrementalism wherein "a fast-moving sequence of small changes…more speedily accomplishes a(n)…alteration of the status quo than (does)…an…infrequent major policy change (Lindblom, 1979)." In the mean time, MS4 communities would do well to prepare for the worst and hope for the best.

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APPENDICES

APPENDIX A: Questionnaire Administered to Municipal Officials

Municipal Stormwater Management in Northern New England

We are seeking to interview a dozen communities in Northern New England that are generally recognized as leaders in the development of municipal stormwater management programs. The broad goals of our interview are to discover:

- what has motivated each community to be proactive in its approach to stormwater management;
- what techniques or tools each municipality has utilized to reduce the impacts of stormwater pollution;
- why each municipality chose the particular tools or techniques for stormwater management over other possible options; and
- how each community finances stormwater management.

This research should help us develop a better understanding of how municipal officials in Northern New England prioritize their stormwater management activities and needs. We hope the data gathered will provide insight about the role local regulations play in effectively managing stormwater. We also hope to identify barriers that have impeded the implementation of low impact development techniques and/or watershed-based management tools along with how these barriers have been overcome. Ultimately, we hope the information we gain from this research will help us create a "toolbox" of effective approaches for managing stormwater pollution while identifying any additional tools that could be useful to municipal stormwater program managers. Before publishing our findings we will share our results with each municipality that has participated in our interviews to ensure all data has been accurately recorded.

The following 14 survey questions were developed through an extensive review process with some of Maine's prominent stormwater professionals to summarize what we hope are the most relevant aspects of municipal stormwater management programs. While we have provided prompts for many of the questions, we would like your responses to be as open ended as possible. We look forward to meeting with you and greatly appreciate your taking the time to share your story with us.

1. What were the reasons for making stormwater management planning a priority? For example, was the decision to establish a stormwater management program based on one or more of the following:
   - Environmental concerns or considerations on the part of municipal officials
   - State or federal stormwater regulations
   - Legal challenges
     - Directed at your community, or
     - Directed at other communities (e.g., threats of legal actions in nearby communities prompted responses in your community)
   - Citizen action / community pressure
   - A catalyzing event such as environmental emergency
   - Others

Municipal Stormwater Management in Northern New England

2. If responding to regulatory requirements (NPDES or otherwise) in developing your stormwater management program, what options or approaches did you consider?
   - Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies)
   - Total Maximum Daily Loads (TMDLs) for impaired water bodies
   - CSO abatement
   - Watershed-Based Management Plans
   - Low Impact Development practices
   - Others

3. How were the elements of your stormwater management program identified, analyzed and selected (e.g., what was the process)?

4. In reviewing site specific development plans, how are stormwater considerations addressed?
   - Through local regulations
     - If through local regulations, are they more or less strict than the state / federal regulations?
   - By deferring to state / federal regulations
     - Does your municipality have delegated review authority to issue stormwater permits?
   - Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale?
   - If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts?
   - Does your development submittal process include peer reviews?

5. Which municipal department(s) is / are responsible for ensuring stormwater management compliance?
   - If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities?
   - How does your community follow up on non-compliance issues?
     - Are there any kind of enforcement procedures in place and if so what do they entail?
   - Does your community require performance bonds or other contingencies for failing systems?

6. Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development?
   - If not, why not (e.g., what barriers have prevented implementation of LID practices)?
   - If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)?

Municipal Stormwater Management in Northern New England

- If so, what types of LID practices or approaches have been implemented (e.g. swales, porous pavement, green roofs, rain barrels, ordinance provisions, etc.)?

7. If your community does employ LID practices, what was the process for establishing / implementing them?
   - What role did / do educational materials play in the LID implementation?
   - What methods were / are used to disseminate this information and how effective have they been?
   - Who are the target audiences for the educational materials?
   - Did your community receive any kind of assistance (technical, financial or otherwise) from partner organizations?

8. Does your community have an "as built" certification process for stormwater BMPs / LID practices (e.g., a process for ensuring that stormwater treatment system plans accurately reflect what was ultimately constructed)?
   - Is the performance of stormwater BMPs / LID practices being monitored and if so, how does your community ensure that BMPs are functioning as intended?

9. Are there any impaired water bodies located in your community (i.e., urban impaired streams, lakes, rivers or other surface waters on the state's 303d list)? If so, what are they?
   - Have TMDLs been approved for any of these waters?
   - If so, which waters have TMDLs and what are the pollutants of concern?
   - If TMDLs have been developed, have they proven to be an effective restoration tool?

10. Have or are watershed management plans being developed for any of these water bodies (or for any "non-impaired" water bodies)?
    - If so, what are the primary goals of each of these watershed-based efforts (e.g., outreach/education, stormwater retrofits, etc)?
    - Who has responsibility for implementing these watershed management plans?
    - What are the benchmarks being used to measure the relative effectiveness of these efforts?
    - What are these assessments revealing?

11. To what extent are shoreland zoning, stream protection overlays, or other zoning tools used to protect surface waters within your community?
    - If zoning tools are used, which water bodies are being protected and which tools are being used?
    - Are these zoning tools proving to be an effective means of protecting water quality in your community and if so, how is this effectiveness measured or determined?

Municipal Stormwater Management in Northern New England

12. How does your municipality currently pay for the operation & maintenance of stormwater infrastructure and what is the total operating budget including any allocations for capital improvements?
    - Are there any portions of the publicly owned stormwater system in your community for which the municipality is not responsible and if so, what are they?

13. Do these funding sources adequately cover stormwater system O&M and capital costs and if not has the community been able to determine the approximate funding gap?
    - Has your community considered other funding mechanisms (e.g., stormwater utilities, impact fees, compensation fee utilization plans)?

14. Does the municipality have enough understanding of its existing stormwater infrastructure to establish a process for considering or anticipating future infrastructure needs and associated costs?
    - If so, what does this process entail and is there a related process for prioritizing needs?

APPENDIX B: Notes from Interviews with Municipal Officials

Bangor Interview – October 28, 2010

Present: Wendy Warren,Bangor Environmental Coordinator; and Arthur Morgan, Design Engineer with Bangor Engineering Department

K. Payson, & D. Roncarati

1. What were the reasons for making stormwater management planning a priority? For example, was the decision to establish a stormwater management program based on one or more of the following:

- Environmental concerns or considerations on the part of municipal officials
- State or federal stormwater regulations
- Legal challenges
- Directed at your community, or directed at other communities
- Citizen action/community pressure
- A catalyzing event such as environmental emergency

- *State and Federal regulations – 2003 when chapter 500 was revised, the state first listed urban impaired streams in bangor*
- *Airport de-icing – no compliance issues with their permits – public outcry in 2003 which caused the DEP to look at Birch Stream.*
- *TMDL at Birch Stream*
- *Regulations and for sensible development – avoid sprawl – unintended consequences. 2003-4 urban impared streams list.*
- *Citizens don't necessarily perceive the streams as impaired*
- *Progressive city mgr who has helped guide this process – now in Lewiston.*
  In 1988 there were 26 CSOs – now there are 5

2. If responding to regulatory requirements (NPDES or otherwise) in developing your stormwater management program, what options or approaches did you consider?
   - Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies)
   - Total Maximum Daily Loads (TMDLs) for impaired water bodies
   - Watershed-Based Management Plans
   - Low Impact Development practices –
   - Others

     TMDLs don't make sense for non-point source pollution and are useless for Non Point source – and bangor. Doesn't explain what effective IC is.

     6 min control measures were already being implemented

     Started with collecting data to find out what the sources of impairment were.

     Watershed based mgmt plans

Data collected: benthic data was collected by the state and their studies were coinciding with very dry years. Wet years things looked better; dissolved oxygen, temperature, ph,(with pajajwok they also tried to understand the impact of headwater marsh on that stream)

Location of development in relation to stream has a big impact – types of BMPs, how do they make a difference.

1. How were the elements of your stormwater management program identified, analyzed and selected (e.g., what was the process)?
Who were the players involved in the process? Engineers primarily before phase II was implemented. Then town mgr and Wendy came on board. Legal Dept has played an active role, as well and codes enforcement.
Developed the Bangor Area Stormwater Group(Milford, Bangor, Vezie, Old Town,.

How were elements identified? Pressure from DEP to include info from other states. <u>Bangor is looking for best results at least cost to local businesses</u>. Asking how will it affect local businesses?

2. In reviewing site specific development plans, how are stormwater considerations addressed?
   - Through local regulations
     - If through local regulations, are they more or less strict than the state / federal regulations?
   - By deferring to state / federal regulations
     - Does your municipality have delegated review authority to issue stormwater permits?
   - Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale?
   - If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts?
   - Does your development submittal process include peer reviews?

Delegated authority over site location development but not stormwater

SW ordinances initially followed state guidelines – but as they developed watershed Mgmt plans their review and standards became more unique to the specific watershed. Would like to develop models that would allow them to model more of a watershed scale impact – are looking for funding for this. Penjajawoc (Mall area) has 3rd party peer review of site plans outside of planning board in an <u>advisory</u> capacity.

3. Which municipal department(s) is / are responsible for ensuring stormwater management compliance? ***Primarily code enforcements on private sites***

- If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities? ***Since 2005 they have a stormwater group that meets monthly – includes planning, codes enforcement, eng (part of PW), environment, sewer dept, and occasionally airport. This helps a lot with coordinating.***
- How does your community follow up on non-compliance issues? ***Primarily code enforcement – particularly on private residences. Engineering and planning support this. Environmental coordinator helps when it is an MS4***
  - Are there any kind of enforcement procedures in place and if so what do they entail?
- Does your community require performance bonds or other contingencies for failing systems? ***Currently grappleing with maintenance of BMPs – they are trying to go beyond MS4 and cover <u>city wide</u> any stormwater and BMP devices rather than just <u>new construction.</u>***

Big flaw of chapter 500 is the poorly enforced maintenance issues of the BMPs.

- Every 5 years they require a 3rd party inspection – but owner needs to inspect and keep a log every year. Their only enforcement would be to go to court – they have yet They hope to utilize stormwater utility to repair orphan detention ponds

In newer developments they require HOA to maintain detention ponds.

Brewer and Hampden require performance bonds for failing systems but Bangor has not..

4. Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development? ***New ordinance for residential subdivisions – to Art's knowledge it has only been used once – clustered housing in close proximity to urban impaired stream.***
   - If not, why not (e.g., what barriers have prevented implementation of LID practices)? ***The driving force behind LID is coming from DEP – they need Proof it works in Bangor – Will it work with soil types in Bangor? Infiltration is bad when protecting the water table. Engineers still like the old way of getting it off site. Developers need to be educated about cost effectiveness. – i.e we build roads and cul-de-sacs to accommodate fire trucks.***
   - If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)? ***The state.***
   - If so, what types of LID practices or approaches have been implemented (e.g. swales, porous pavement, green roofs, rain barrels, ordinance provisions, etc.)?

5. If your community does employ LID practices, what was the process for establishing / implementing them? ***Do recommend several LID practices in mgmt plan. The city has implemented this in new LEED projects. Who maintains the garden? Landscapers or the town? Education needs to occur on how to maintain them. They do refer to the UNH sw ctr b/c it is in NE. They are installing examples around town – Easter Maine CC, K-Mart,***

Car dealer. Putting in signs that educate developers - 2 porous pavement projects, 2 storm tech units, 2 filtares sp?). Only way to make porous pavement is to do it during construction to avoid cost of developing detention pond. As an **aside – Genest in Windham uses porous brick(Portland cement project) to allow filtration to avoid having to salt so much at building entryway.**

- What role did / do educational materials play in the LID implementation?
- What methods were / are used to disseminate this information and how effective have they been?
- Who are the target audiences for the educational materials?
- Did your community receive any kind of assistance (technical, financial or otherwise) from partner organizations?

6. Does your community have an "as built" certification process for stormwater BMPs / LID practices (e.g., a process for ensuring that stormwater treatment system plans accurately reflect what was ultimately constructed)? ***Yes. As Built handled through codes enforcement – emphasis more on "what you could see" but now they focus on the work underground. Require as builts before they receive Certificate of Occupancy.***
They have talked about adding a "land use" inspector to codes enforcement. Development coordinator does some of this.

   - Is the performance of stormwater BMPs / LID practices being monitored and if so, how does your community ensure that BMPs are functioning as intended? ***No – they hold out the CO for the private developer until they receive the BMPs. They have talked about adding a Land Use Inspector to their staff – but that hasn't happened yet. They have someone in Codes who does some of this already.***

7. Are there any impaired water bodies located in your community (i.e., urban impaired streams, lakes, rivers or other surface waters on the state's 303d list)? If so, what are they? ***6 Pajajowac – TMDL shelved by DEP due to huge citizen response; Arctic Brook, Shaw Brook, Capehart Brook, Sucker Brook, <u>Birch stream is only one with TMDL approved.</u>***
   - Have TMDLs been approved for any of these waters? ***Birch Stream (only one with full fledged TMDL – airport Glycol***
   - If so, which waters have TMDLs and what are the pollutants of concern? ***Temp, dissolved oxygen, chlorides in at least one,***
   - If TMDLs have been developed, have they proven to be an effective restoration tool?

   Residual designation has been enough for them to monitor these water bodies.

8. Have or are watershed management plans being developed for any of these water bodies (or for any "non-impaired" water bodies)? ***Penjajawoc, Birch and 3rd being started for Capeheart in November 2010.***
   - If so, what are the primary goals of each of these watershed-based efforts (e.g., outreach/education, stormwater retrofits, etc)? Who has responsibility for implementing these watershed management plans?

- What are the benchmarks being used to measure the relative effectiveness of these efforts?
- What are these assessments revealing?

  Capehart is on the highly restorable streams list – received grant $ to work on restoration so have to have a mgmt plan. – smaller process in Birch Stream and probably have very little public input with Capeheart b/c very little economic impact. – Having a stakeholder process as a requirement is a waste of time.

9. To what extent are shoreland zoning, stream protection overlays, or other zoning tools used to protect surface waters within your community? ***75 ft shoreland zone as required by state. Once watershed is developed it is hard to go in and put a stricter requirement b/c if it were damaged couldn't rebuild. – the SWMPs there is a provision to look at buffers and setbacks – and if they do anything, they need to do it citywide***
   - If zoning tools are used, which water bodies are being protected and which tools are being used?
   - Are these zoning tools proving to be an effective means of protecting water quality in your community and if so, how is this effectiveness measured or determined?

     DEP gives variance that goes against their rules – frustrating

     To keep it fair / level playing field they do the standards city wide – no special areas or overlays.

10. How does your municipality currently pay for the operation & maintenance of stormwater infrastructure and what is the total operating budget including any allocations for capital improvements? ***General fund – tax base. Would like to develop a stormwater operating budget – 1.2 million is what they would like to utilize in the stormwater utility*****. If you added capital projects it**

    90K for street sweep, 200k overall operating budget which includes 90k

    - Are there any portions of the publicly owned stormwater system in your community for which the municipality is not responsible and if so, what are they?

11. Do these funding sources adequately cover stormwater system O&M and capital costs and if not has the community been able to determine the approximate funding gap? ***NO***
    - Has your community considered other funding mechanisms (e.g., stormwater utilities, impact fees, compensation fee utilization plans)? ***Working on stormwater utility. Have CFUP in place which generate a 1 time fee – not sustainable – Penjajawoc, Birch and Artic stream. They are general terms – but no plans for what to do with it. They are approved by DEP – were able to get other ARRA grant money to pay for things in the plan so have to get reapproved by DEP on how they can spend the money.***

12. Does the municipality have enough understanding of its existing stormwater infrastructure to establish a process for considering or anticipating future infrastructure needs and associated costs? ***Engineer: yes – Environment: no***
    a. If so, what does this process entail and is there a related process for prioritizing needs?

MS4 education should fall to the state, not the community – esp since (…since what?)

Don't have a plan – how much line needs to be replaced? Need to map separate from sewer system.

Long range plan is to get 5 streams into compliance. Would like to have the benthic data done every year on each of them – but too costly.

What is it that they are unable to do that they haven't done?

For toolbox: State of Maine does not allow you to put a lean on property to bring property into compliance. Only resolution is to go to court. Would be nice if state could give others the accreditation to collect and analyze benthic data. DEP is only game in town.

Salt mgmt – statewide issue – balance of risk & environment.

BURLINGTON, VT ~

Phone Interview augmented with Megan's Notes

March, 4, 2011

Megan Moir, Doug Roncarati and Keisha Payson

We are seeking to interview a dozen communities in Northern New England that are generally recognized as leaders in the development of municipal stormwater management programs. The broad goals of our interview are to discover:

- What has motivated each community to be proactive in its approach to stormwater management;
- what techniques or tools each municipality has utilized to reduce the impacts of stormwater pollution;
- why each municipality chose the particular tools or techniques for stormwater management over other possible options; and
- how each community finances stormwater management.

This research should help us develop a better understanding of how municipal officials in Northern New England prioritize their stormwater management activities and needs. We hope the data gathered will provide insight about the role local regulations play in effectively managing stormwater. We also hope to identify barriers that have impeded the implementation of low impact development techniques and/or watershed-based management tools along with how these barriers have been overcome. Ultimately, we hope the information we gain from this research will help us create a "toolbox" of effective approaches for managing stormwater pollution while identifying any additional tools that could be useful to municipal stormwater program managers. Before publishing our findings we will share our results with each municipality that has participated in our interviews to ensure all data has been accurately recorded.

The following 14 survey questions were developed through an extensive review process with some of Maine's prominent stormwater professionals to summarize what we hope are the most relevant aspects of municipal stormwater management programs. While we have provided prompts for many of the questions, we would like your responses to be as open ended as possible. We look forward to meeting with you and greatly appreciate your taking the time to share your story with us.

Burlington was the second community (after South Burlington) to pursue dedicated stormwater funding, with Chapter 26 passed in late 2008 and made effective in April 2009. While Burlington's stormwater user fee is not official a utility (I believe because we didn't want to pursue changing the charter?) it is an enterprise fund, meaning that all $ collected goes to stormwater management. The $ provides for a dedicated stormwater administrator (me, since July 2009) and for some fraction of other staff members time. It is important to note that while the framework and authority for the stormwater program was made effective in 2009, there is still

much programmatic development to be done: forms to be developed, outreach programs to be developed, trainings to be done, GIS mapping updates, workflow processes etc.

1. What were the reasons for making stormwater management planning a priority? For example, was the decision to establish a stormwater management program based on one or more of the following:

- Environmental concerns or considerations on the part of municipal officials - To some extent, I think municipal officials and staff recognized the need to obtain funding to better meet our regulatory requirements; but also to make sure that we had clean water for recreation. Beach closures due to bacterial counts at Blanchard Beach (mouth of Englesby) in the late 1990s encouraged the City to hire the Center for Watershed Protection to develop a watershed restoration plan and to implement various stormwater treatment retrofits which have been successful in reducing bacterial counts and reducing the frequency of beach closures. In my experience, municipal officials in Burlington want to do what is right for the environment, but until funding and staff were available to focus on and coordinate the efforts of a dedicated stormwater program, stormwater was only one of many priorities at the department of public works.
- State or federal stormwater regulations - This was probably the biggest reason – the need for a dedicated program to make sure that we stay in compliance with regulations.
    - Yes – Became a Phase II MS4 in 2003, required to meet the 6 minimum measures; also the development of flow based TMDLs for the stormwater impaired watersheds – namely Englesby Brook, but also Centennial Brook and Potash Brook encouraged the City to pursue a dedicated funding stream (it's not an official utility, but we charge a fee that goes directly to the stormwater program). See attached flyer. Additionally the city is a joint permit holder on a number of state stormwater permits and there are inspection and reporting requirements for those on an annual basis. Staying compliant with existing regulations and preparing for FUTURE regulations that are definitely coming is probably the biggest driver.
    - State CSO policy mandating no overflows for storms smaller than 2.5", 24 hour storm.
- Legal challenges:
  Directed at your community, or
    - Not so much legal action directed at us, but the threat of CLF appealing permits for developments etc is always a possibility

  Directed at other communities (e.g., threats of legal actions in nearby communities prompted responses in your community)

- Citizen action / community pressure - **Some citizen pressure (esp. from Burlington Conservation Board); customer service requests regarding drainage issues.**
- A catalyzing event such as environmental emergency
- Others
    - Knowledge that infrastructure is aging and in need of maintenance and repair.

2. If responding to regulatory requirements (NPDES or otherwise) in developing your stormwater management program, what options or approaches did you consider?

I would consider some of the below to be approaches… other things seem to be more regulatory requirements… so I am not sure exactly how to answer some of these.

- Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies)
    - We have to meet these as part of our MS4 permit. This is not an exhaustive list, but: For MM #1, Burlington participates in a regional effort with the other MS4 towns (Regional Stormwater Education Program) – see www.smartwaterways.org. For MM#2, we have tried to do our own workshops/public outreach – but are about to launch a regional effort for that minimum measure too. For MM3, IDDE – we have pursued and continue to pursue the standard programs to identify and fix any illicit connections. For MM4 and 5 (construction and post-construction stormwater) we have established authority to review and approve projects that are disturbing > 400 s.f. of earth. All of those projects require EPSC measures. Many require post-construction stormwater management (the thresholds and requirements are still being developed based on the impact of various size projects and where they are located – direct to lake, to CSS, to impaired streams etc). For MM6 we have made what I consider the typical improvements to our municipal activities – including spill prevention, wash stations (working to upgrade this), EPSC measures on public projects etc.
- Total Maximum Daily Loads (TMDLs) for impaired water bodies – Yes – draft MS4 permit requires the development and implementation of Flow Restoration Plans for the stormwater impaired waters. The EPA recently reversed approval for the Lake Champlain Phosphorus TMDL – and we may see additional measures related to that TMDL woven into our permit.
- CSO abatement –**yes –** this is a focus. We implemented 1.2 million in federal stimulus funding this year (and a little bit this coming spring) to reduce stormwater going to the combined system. Some of this was redirection of stormwater from the CSS to the Separate Storm, but a large portion of the project involved infiltrating stormwater on-site (underneath the road).
- Watershed-Based Management Plans – This was used in the past (see above regarding Center for Watershed Protection and Englesby Brook). In the future we will be required to develop Flow Restoration Plans for the stormwater impaired watersheds – for us we will be responsible almost fully for Englesby Brook.
- Low Impact Development practices – Yes, we are working to make sure that both Public and Private projects use LID techniques
- Others

3. How were the elements of your stormwater management program identified, analyzed and selected (e.g., what was the process)?

The Chapter 26 re-write (see attached) was done before I arrived. We also did a DIMS in 2005 to look at forming a SW utility/dedicated program. But much of the elements, I guess, are still being identified, analyzed and selected.

4. In reviewing site specific development plans, how are stormwater considerations addressed?

- Through local regulations -Yes. Chapter 26 stormwater standards.

If through local regulations, are they more or less strict than the state / federal regulations?

MUCH MORE strict. [I used to work for the State Stormwater Section]. Triggered by > 400 sf of disturbance or greater. (The state EPSC standards are triggered by 1 acre + of disturbance or > 1 acre of impervious surface). Right now we are looking at requiring stormwater review for ANY project where the total proposed impervious is > 2500 s.f. . Additionally, for the post-construction stormwater analysis – projects are required to evaluate the feasibility of mitigating existing/redeveloped impervious as well as new impervious.

- By deferring to state / federal regulations - NO
- Does your municipality have delegated review authority to issue stormwater permits? – NO, state permits are still issued for large projects, of which there are few in a built out place like Burlington when the threshold is 1 acre +

- Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale?
  Mostly at site level. We don't have a working watershed/sewershed wide H/H model. But the thresholds are set so low (> 2500 s.f. total proposed impervious) because of the acknowledgement of the cumulative impacts!
- If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts? Right now, the local watershed restoration efforts would be led and funded by the Municipality (as required by the MS4 permit) and yes, the thresholds and the requirements for stormwater management are in synch with the requirements of the stormwater impaired waters TMDLs to reduce flow substantially.
- Does your development submittal process include peer reviews? I am the main reviewer for EPSC and stormwater management plans. Not sure if I understand the questions.

5. Which municipal department(s) is / are responsible for ensuring stormwater management compliance?

The stormwater program is housed in the department of public works, but some of the review/review process is triggered by planning and zoning permits. They often reference my approval in their zoning permits. There is also room for us to involve the department of code enforcement for inspections and enforcement. As a new program, this is all still being worked out. Right now, with all the programmatic development and the project development, it has been hard to perform as many inspections as I would like. I am currently working on developing a computerized tracking system using the program that is used by our other trades inspections (building permits, electrical etc)… and this should make project tracking and compliance easier.

- If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities? We could do better, but we are figuring out a flow path.

- How does your community follow up on non-compliance issues? Compliance issues have typically been worked out through site visits/ phone calls etc. But we have enforcement and penalty authority.

Are there any kind of enforcement procedures in place and if so what do they entail?

See Chapter 26.

- Does your community require performance bonds or other contingencies for failing systems?
- I think sometimes Planning and Zoning require performance bonds, but we have not experimented with yet.
- We are working on a O&M agreement/easement that will allow us the right to enter property and maintain a failing system if an owner is not maintaining it and then to charge the owner.

6. Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development?

We prefer that LID be used where feasible, but is not a requirement.

- If not, why not (e.g., what barriers have prevented implementation of LID practices)?
- If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)? Just professional knowledge. It's proven to work. It's supported in the City of Burlington
- If so, what types of LID practices or approaches have been implemented (e.g. swales, porous pavement, green roofs, rain barrels, ordinance provisions, etc.)?
    - Green roofs, pervious pavement, bioretention areas, rain barrels – they are all on the table and have been used to varying degrees. – developers and single family homes - champlain college using bioretension system and double rain barrel entry box filters – the city has used pervious concrete and last year they also started some rain garden bumpouts. A neighborhood that wanted traffic calming bump-outs so she has turned it into rain gardens. Also they are using subsurface infiltration underneath the road

7. If your community does employ LID practices, what was the process for establishing / implementing them?

Still working on this. May be a part of MM2 regional effort. Right now LID happens likely because of regulatory requirements.

- What role did / do educational materials play in the LID implementation?
- What methods were / are used to disseminate this information and how effective have they been? There is a Small sites guide from the State. Still trying to figure out how to use it… probably for projects that I have technical assistance meetings with or homeowners with > 2500 s.f. impervious that need to disconnect additional impervious.
- Who are the target audiences for the educational materials? Homeowner
- Did your community receive any kind of assistance (technical, financial or otherwise) from partner organizations? NO – state produced a small sites stormwater BMP guide that is all LID based. Statewide LID roundtable. Doug: Noted that they seem to put more energy into LID efforts than they get in benefits; There are lots of champions but not a targeted appproach; VT NEMO, Seagrant, VT Rain Garden Manual

(http://www.uvm.edu/~seagrant/communications/assets/VtRainGardenManual.pdf); Local conservation district

8. Does your community have an "as built" certification process for stormwater BMPs / LID practices (e.g., a process for ensuring that stormwater treatment system plans accurately reflect what was ultimately constructed)?

Yes – though details are still being developed.

- Is the performance of stormwater BMPs / LID practices being monitored and if so, how does your community ensure that BMPs are functioning as intended? Not being quantitatively monitored. "Formal" LID practices will be required to be inspected annually. Still working out whether "homeowner" LID practices will require inspections by homeowner, or annual inspections by DPW…

9. Are there any impaired water bodies located in your community (i.e., urban impaired streams, lakes, rivers or other surface waters on the state's 303d list)? If so, what are they?

Yes – Englesby Brook, Centennial Brook, Potash Brook. TMDLs approved, based on flow. They have not been implemented yet. Requirement to implement is in the future MS4 permit, to develop flow restoration plans and to implement. Also TMDL for Lake Champlain (Phosphorus) – was approved and then recently approval was rescinded by EPA – EPA wants them to redo it. I think the Lake Champlain TMDL has been implemented to some degree.

Have TMDLs been approved for any of these waters?

- If so, which waters have TMDLs and what are the pollutants of concern?
- If TMDLs have been developed, have they proven to be an effective restoration tool?

Flow restoration plans – have to come up with the number and type of BMP's that will help them meet that TMDL – it will be a challenge for VT municipalities to implement these restoration plans. For Ingelsby alone it will be about $4Million dollars – she thinks maybe more. Will be required to implement this in 7 years – but Megan thinks the timeframe should be included as part of the flow restoration plan – i.e. allow up to 15 years.

They would rather install BMPs than do the measurements In stream phosphorous "legacy phosphorous" – excess flow causes in-stream erosion and

10. Have or are watershed management plans being developed for any of these water bodies (or for any "non-impaired" water bodies)? All Chittenden County beholden to develop "Flow Restoration Plans"

(due to CLF or another group suing Lowe's VT around 2000 - resulting in SWAG – stormwater advisory group – we should look at this…) Doug: Dept. of Conservation - developed a BMP decision support tool that helps a community determine or estimate the number & type of BMPs they need to restore the watershed on a sub-watershed by sub-watershed basis; Restoration plan for Englesby Brook would be about $4million and have to be fully implemented in 10 years; She thinks that 10 years is too fast - would like to see a 15-20 year timeline

If so, what are the primary goals of each of these watershed-based efforts (e.g., outreach/education, stormwater retrofits, etc)? Have to develop Flow restoration plans and then have to meet the goals within 10 years. Municipalities are the ones that are going to be held responsible to meet these goals and pay the cost.

- Who has responsibility for implementing these watershed management plans? Municipalities they cross.
- What are the benchmarks being used to measure the relative effectiveness of these efforts?
- What are these assessments revealing?

11. To what extent are shoreland zoning, stream protection overlays, or other zoning tools used to protect surface waters within your community? If zoning tools are used, which water bodies are being protected and which tools are being used? Are these zoning tools proving to be an effective means of protecting water quality in your community and if so, how is this effectiveness measured or determined?

CONTACT Scott Gustin – Planning and Zoning sgustin@

Megan has review or authority to review anything that disturbs over 4,000 sq ft.

Doug: 100' buffer for wetlands, lakes and streams - Higher level of review required before development is allowed within this buffer

12. How does your municipality currently pay for the operation & maintenance of stormwater infrastructure and what is the total operating budget including any allocations for capital improvements? 2009 started collecting stormwater fees – bringing in $725K, but was designed to bring in $1M – so trying to figure out how to bring that back up to 1M. Doug: This funds capital improvements and salaries; Large parcels get credits for mitigating for their stormwater impacts

Are there any portions of the publicly owned stormwater system in your community for which the municipality is not responsible and if so, what are they? No – if anything there are a couple of roads that used to be private but now Burlington has taken it over.

13. Do these funding sources adequately cover stormwater system O&M and capital costs and if not has the community been able to determine the approximate funding gap?

They want to get up to 1Million – i.e. more personel to run the vactor truck – or more money to hire out for consultants. They don't know what the magical number would be - but she suspects that in the next 2 or 3 years once the flow restoration plans are done and they begin to figure out the types and number of BMPs will be needed to meet the target flows.

They think they won't have too much trouble if they have to raise their rate because So. Burlington is already higher than theirs ($4 – and plan to raise it soon).

Out west in some places it's 3 or 4 times that much.

Has your community considered other funding mechanisms (e.g., stormwater utilities, impact fees, compensation fee utilization plans)?

14. Does the municipality have enough understanding of its existing stormwater infrastructure to establish a process for considering or anticipating future infrastructure needs and associated costs?

Don't have very good GIS data – but this year they have a grant to update their mapping and attribute tables - set up their GIS so it could be used into H&H hydrological models – so they can keep track of their assets and better asses needed maintenance so they can work that into a capital improvement plan (e.g.: track the pipes that have been televised, prioritize retrofits needs, etc). They are asking consultants for suggestions on best asset management system. Might try for a VT Transit grant to pay for this system. Noted that South Burlington developed its own asset mgt system with some degree of real-time functionality.

If so, what does this process entail and is there a related process for prioritizing needs?

Dover, NH Stormwater Program Development ~ 2/4/11

Interview of Dean Peschel by R. Melanson & F. Dillon

Q1: Reasons for prioritizing SW management

- Proactive response to impending regulations
- Background / related info
    - Water & sewer were closely regulated thus establishing need for enterprise fund
    - Following enactment of CWA, sewer system was a focus; SW and sewer systems were separated.
    - Planning Dept began using GIS in 1989, which evolved into mapping work for DPW.
    - Mapping of system identified lack of funding for SW system.
    - At the time, it was difficult to get local officials to acknowledge importance of underground infrastructure (out of sight out of mind)
    - Ref to GASB 34 (Governmental Accounting Standards Board), which requires local gov. to begin reporting all financial transactions, including the value of their infrastructure assets, roads, bridges, water and sewer facilities, and dams, in their annual financial reports on an accrual accounting basis (Wikipedia).
    - In late 90's, EPA began informing communities of Phase II / MS4 program requirements. City anticipated need to educate council and community. Acquired 319 grant to conduct additional mapping of SW system.
    - DES was focusing on bacteria issues and conducted IDDE program for City, which benefited greatly from all mapping work that had been done in anticipation of MS4 program development / implementation. Numerous cross connections were eliminated as a result.

Q2: Options / approaches considered in response to regulatory requirements

- Conducted "gap analysis" in response to anticipated Phase II rules: compared EPA's expectations to what more City needed to do to comply.
- No TMDLs
- No CSOs
- WBMP and LID came after initial program implementation (see below)

Q3: How SW program elements were identified

- Gap analysis as described above.
- Also involved with Seacoast Stormwater Coalition, which formed in response to SW program requirements.

Q4: How site specific development plans address SW considerations

- City engineer reviews all proposals. Attitudes toward SW management have evolved over the years from designing strictly for hydraulic considerations (i.e., to remove water quickly) to understanding the need to also consider WQ impacts. Regulatory requirements have also helped drive this understanding.
- Which rules (fed vs. local) are invoked depends upon project size, though SW permit obligations ultimately derive from EPA (City does not have delegated SW permitting authority).
- Most SW design considerations occur as a condition of approval rather than as a formal zoning rule. No specific SW ordinance; modified site plan review process.
- Dover has a great planning review model. Happens as follows:
    - Developer meets with planner
    - Prelim plan sent to PB
    - PB refers prelim plan to Tech Review Committee
    - In most cases, all SW concerns are fully addressed before full PB review.
    - CC also reviews certain projects in sensitive areas (e.g., wetlands)
- Not clear if development review goes beyond site level concerns to w'shed scale…
- Cocheco River W'shed Coalition was founded by CC chair and has goals that are in alignment with City's WQ protection efforts. Cocheco added to state River Management and Protection Program.
- Peer reviews happen only for controversial / contested projects.

Q5: Municipal departments responsible for ensuring SW program compliance

- Primarily DPW and Planning; Fire Dept for spills
- DPW shares staff, equip and facilities with WW and water.
- Engineering provides ESC inspections for new / redevelopment; have well defined process for contractors to follow.
- Building inspections also include SW management considerations.
- Various SW program responsibilities shared and coordinated well between departments

- Noncompliance / enforcement usually isn't a problem (95% compliance), but option always exist to shut project down.
- Performance bonds are required for projects based on estimate of how much it would cost to restore site disturbance.

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

- Don't insist on LID but encourage use
- PB had to be educated about LID
- Using cluster development for open space preservation
- Now looking at encouraging use of infiltration systems
- Regulatory pressure helps drive reluctant / skeptical engineers to be more accepting of LID practices; still concerns that systems aren't proven and won't work well.
- UNHSC has proven to be helpful in promoting use of LID

Q7: Process for establishing / implementing LID practices

- Don't want to be prescriptive with LID; prefer to let engineers come up with solutions
- Incentives in zoning ordinance for cluster development
- Also rely on educational resources from Seacoast SW Coalition
- Ref. to pet waste program and development of logo; community survey for pet waste perceptions; no poop pledge during annual dog registrations with annual prize.

Q8: "As built" certification process for SW BMPs

- Part of overall development review process: new projects must have SW management plan that specifies annual O&M requirements.
- Consultant (GZA) recently developed on-line SW BMP tracking system that Dover now uses for 36 sites.

Q9: Impaired waters in Dover

- Berry Brook listed for bacteria and macroinvertebrates but no TMDLs

Q10: WMPs for impaired waters

- Recently developed WMP for Berry Brook and ~$700K will be used to implement plan recommendations (funds obtained through grants with assistance of UNHSC).

Q11: How zoning tools are being used to protect WQ

- See response to Q4 above.

Q12: How SW program O&M and CIP are funded

- Currently 100% from general fund
- However, recently completed Municipal Stormwater Feasibility Study provides road map for where City will likely be headed with SW program funding. (Fee will primarily be based on IC).
    - Prior to this process, City believed it was spending ~$250K on SW; after they discovered it was ~$900K.

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

- Current funding isn't adequate: estimate that it will need to increase from current $900K to ~$2.2M by end of next 5 year permit (will likely be done in annual steps).
- Would like to replace 1% of system annually.
- CIP separate budget from O&M funds.
- See response to Q12 for alternate funding sources.

Q14: Adequate understanding of existing SW system to anticipate future costs

- Yes based on knowledge of different ages of SW system components.

Not clear if process exists for prioritizing future SW program needs…

Essex Junction, VT Stormwater Program Development ~ April 11, 2011

Interview of Jim Jutras by R. Melanson & F. Dillon

Q1: Reasons for prioritizing SW management

We took the approach of maintenance of systems that are installed. We have always practiced what is known now as asset management. That has been the reason for taking care of systems which has helped to take care of water quality. We modified current practices, as needed, when the phase 2 permit came out.

- Found out about Phase II about 8-9 years ago at a SW conference
- Community is "built out" to some extent, thus planning is largely redevelopment
    - One large farm, creates major open space within community
    - Subdivision threat on remaining open space is low
    - Community is fairly progressive in regards to conservation/ planning
    - Cited Act 250

Appeals were of state permits, MS4's were an interested party. There was one specific legal challenge that I recall but it was in South Burlington and was a private party. Environmental group pressure and litigation to a state level.

Interviewr note: It seemed as though community was managing stormwater prior to "being forced", but since Phase II, it appears as though a more methodological approach is happening, so in some way

Q2: Options / approaches considered in response to regulatory requirements

Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies) yes with cooperative approaches where feasible.

Total Maximum Daily Loads (TMDLs) for impaired water bodies Lake Champlain Only TMDL at this time.

CSO abatement None to address in our community

Watershed-Based Management Plans in pending permit under appeal. Appeal is delaying implementation.

Low Impact Development practices LID practices were in place before LID was coined. General planning tools have always been part of land development code and plans reviews.

- Regional SW program
    - State pushed to have regions address SW management
    - Helped with feasibility studies
- Thought was "why have different programs, when outlets are the same?"
    - Stream teams
    - Grants
    - Take outreach away from municipalities so they can focus on on the ground inmprovements…
    - Smart water ways website http://www.smartwaterways.org/

Q3: How SW program elements were identified

Current practices, review of available tool boxes were reviewed. We readily incorporated what fit in with our normal operations. We were already doing the BMP's and had done so for many years without recording the quantities of inspected systems, sediment removed, etc.

- VT has Lake Champlain TMDL under appeal (disapproved at this point)
- Permitting is "up in the air"
- Once the appeal is lifted permit will be released so that implementation may begin…but right now most SW programs are on hold.

Q4: How site specific development plans address SW considerations

In reviewing site specific development plans, how are stormwater considerations addressed?

Through local regulations Yes, even if the standards were not enacted, the plans were reviewed as if they were…most understood that the minor additional requirements would be good for them to address as part of the new construction.

➢ If through local regulations, are they more or less strict than the state / federal regulations? Local as required by regulations. Typical regulatory requirement is to meet or exceed the state standard

By deferring to state / federal regulations Current requirements incorporate state requirements by reference where appropriate.

➢ Does your municipality have delegated review authority to issue stormwater permits? No but we detail site review and require calculations. A lot depends on the size of the project.

Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale? Local only at this time

If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts?

Does your development submittal process include peer reviews? NO. but they are reviewed by the Village contracted engineer.

Q5: Municipal departments responsible for ensuring SW program compliance

Water quality via the wastewater facility chief operator/water quality superintendent.

If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities? Very well. Small community with small staff. All was originally under public work but that changed with increasing complexity of stormwater permitting, litigation and staffing changes due to retirement.

How does your community follow up on non-compliance issues? We maintain right of entry and authority to shut projects down, take over remediation and back-charge as well as other options. Most development is infill. There are few subdivisions, planned residential developments, etc. When there are they usually fall under state permitting requirements.

➢ Are there any kind of enforcement procedures in place and if so what do they entail? > 1A, turn them in to the state. Less than 1 Ac, various code enforcement remedies

Does your community require performance bonds or other contingencies for failing systems? No, not yet. Most systems are designed to municipal standards and turned over to the community after a stabilization period and substantial completion.

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development? See earlier comments.

If not, why not (e.g., what barriers have prevented implementation of LID practices)? The only barrier we seem to have is that we employ LID practices and they are not always recognized as such because we do not call it LID

If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)? common sense: i.e. rainbarrels are great but what if the homeowners do not drain them…. No improvement. There are many other LID practices that have minor benefit from hydraulic standpoint but have tremendous impact from an education and awareness standpoint.

- Of note: Jim believes that LID at this point is more educational than practical for their needs in regards to flow attainment…
- Hired social marketer (state of VT) to develop outreach efforts…

Q7: Process for establishing / implementing LID practices

- Comes down to what makes sense…and having a consistent message
- Smart waterways
    - Outreach efforts driven by:
        - Winooski NRCD
        - UVM (who are a non-traditional MS4)
        - Ecco aquarium (dr. Mary Watson)

Q8: "As built" certification process for SW BMPs

- No as built inspection required
- No 3rd party inspection
- They do have an inspection and correction process
- Erosion control monitoring during construction

Q9: Impaired waters

- Sundelin Brook – meeting attainment
- Indian Brook
    - Have not derived flow models yet
    - Flow restoration planning
    - TMDLS in permit…permit on hold
    - Volume is the concern

Q10: WMPs for impaired waters

- Municipality is responsible for implanting regional watershed mgt plan

- Burden of municipality to address non compliance based upon WMP
- Residual designated authority
    - Town offers carrots…state is the stick

Q11: How zoning tools are being used to protect WQ

- Stream Bank buffers
- Appeal by CLF on buffer encroachments
- Non-conformity issues – structures are grandfathered
- 50' setback limits
- Floodways are also seen as buffers of no development

Q12: How SW program O&M and CIP are funded

- General fund
    - Line items for Sw maintenance
- There has never been a metric for budgeting for SW management
- No ballpark $$ figure for program
- PACP process/ check list (Pipe Assessment Certification Process)
    - 100% done for sewer lines
    - All systems rate at 3 or better
    - SW system will likely follow this process

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

Q14: Adequate understanding of existing SW system to anticipate future costs

Exeter Interview – January 26, 2011

Present: Sylvia VonAulock, Exeter Town Planner – town of 14,000

K. Payson, & D. Roncarati

1. What were the reasons for making stormwater management planning a priority? For example, was the decision to establish a stormwater management program based on one or more of the following:

- Environmental concerns or considerations on the part of municipal officials
- State or federal stormwater regulations
- Legal challenges directed at your community, or directed at other communities
- Citizen action/community pressure – *The Alderman believes that flooding has driven the alderman to address stormwater. No public outcry that has pushed them on this -*
- A catalyzing event such as environmental emergency

Planner there 11.5 yrs – spent 8 yrs as an engineer for city of Seattle working on erosion, infiltration

Planning board was open to environmental issues and alarmed to the water quality issues

Location on Great Bay - Exeter River, Lampry River, Swampscot River, lots of wetlands.

At 11% impervious surface you reach that tipping point – Exeter is now beyond that – but was only 8 or 9% impervious when she arrived.

Salts in the water from winter plowing

Also NPDS

Let property owners know early on that they were open to progressive stormwater management techniques.

8 years ago they were encouraging all developments to use the pervious pavement – now they are doing a 180 on this issues because they are finding that to maintain it people are over salting the pavement – and it is porous so it all goes into the groundwater, which all eventually gets to the Great Bay.

2. If responding to regulatory requirements (NPDES or otherwise) in developing your stormwater management program, what options or approaches did you consider?
   - Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies)
   - Total Maximum Daily Loads (TMDLs) for impaired water bodies
   - CSO abatement
   - Watershed-Based Management Plans
   - Low Impact Development practices –

- Others
  Ask Phyllis

3. How were the elements of your stormwater management program identified, analyzed and selected (e.g., what was the process)?
   Ask Phyllis

   She's done stormwater drain stenciling

   Training with public works staff

   All snow plows have computerized systems to distribute salt – talk with Jay Perkins

   Finding this computerized system is saving lots of salt and money.

   Designated Low Salt area for urban impaired stream (swampscot river)

   Dog waste containers in 10 different locations downtown and people use them all the time.

4. In reviewing site specific development plans, how are stormwater considerations addressed?
   - Through local regulations ***Exeter – through local regs. Work with design engineer on creating innovative stormwater mgmt techniques as possible – have several underwater stormwater galleries in downtown area – 2 hotels and stop and shop parking lots. Riverwoods retirement homes has innovative systems that get looked at all the time by both the developer and the town. Local site specific drainage analysis plans are reviewed by the state – they have outside engineers who help submit them.***
   - If through local regulations, are they more or less strict than the state / federal regulations?
   - By deferring to state / federal regulations
   - Does your municipality have delegated review authority to issue stormwater permits?
   - Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale? ***Regs speak to rate on site but not volume – don't take cumulative view. Focus has been on water quantity but not water quality***
   - If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts?
   - Does your development submittal process include peer reviews? ***Yes – sent to one of two outside consultants.***

   Require any development to have the property owner or design engineer to sign a maintenance agreement and design a maintenance manual for their system.

5. Which municipal department(s) is / are responsible for ensuring stormwater management compliance? ***Planning & Public Works – well coordinated and includes the outside consultant that reviews the stormwater mgmt stuff.***

If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities? How does your community follow up on non-compliance issues? ***they avoid non-compliance by setting up a safeguard in the beginning. Have on-site inspectors. Developer has to put up a performance bond. The town gets the money up front and the developer gets money back once inspector says it was built according to plan. Once performance bond is released, they also require a maintenance bond for two years out.*** Are there any kind of enforcement procedures in place and if so what do they entail? Does your community require performance bonds or other contingencies for failing systems?

They had one example – when the developer wasn't listening to Exeter (stockpiling up against a prime wetland) – so they involved NH DES and the developer listened. There is a thorough understanding that the developer won't get the money back unless they comply.

Not a lot of "official enforcement" other than planning board members following up with development plans.

6. Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development? ***Yes***

- If not, why not (e.g., what barriers have prevented implementation of LID practices)?

If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)? ***Yes. Planning Board is very well versed in LID and are always drilling developers on what they are using for LID and why not using them if not in their plans.***

- If so, what types of LID practices or approaches have been implemented (e.g. swales, porous pavement, green roofs, rain barrels, ordinance provisions, etc.)?

Living detention systems, underground drainage galleries,

7. If your community does employ LID practices, what was the process for establishing / implementing them? ***2003 overhaul on site and sub regs – started to include them then. One of their 2 reviewers is the local SWCD and they are very supportive of these innovative systems.***

What role did / do educational materials play in the LID implementation? ***Have the Great Salt Bay education center – provide educational workshops i.e. "the Road Less Salted" and are a great liaison to the municipality.***

- What methods were / are used to disseminate this information and how effective have they been?
- Who are the target audiences for the educational materials?
- Did your community receive any kind of assistance (technical, financial or otherwise) from partner organizations?

8. Does your community have an "as built" certification process for stormwater BMPs / LID practices (e.g., a process for ensuring that stormwater treatment system plans accurately reflect what was ultimately constructed)? ***Yes***
   Is the performance of stormwater BMPs / LID practices being monitored and if so, how does your community ensure that BMPs are functioning as intended?

9. Are there any impaired water bodies located in your community (i.e., urban impaired streams, lakes, rivers or other surface waters on the state's 303d list)? If so, what are they? ***Terresa Walker – Rockingham Planning Commission – she helps bring state and towns together on bigger picture – for example she is working on bringing state and towns together on new regs for floodplain management – Exeter River and fluvial geomorphology.***
   - Have TMDLs been approved for any of these waters? If so, which waters have TMDLs and what are the pollutants of concern?
   - If TMDLs have been developed, have they proven to be an effective restoration tool?

10. Have or are watershed management plans being developed for any of these water bodies (or for any "non-impaired" water bodies)? ***Yes - also have ERLAC Exeter River Local Advisory Committee***
    - If so, what are the primary goals of each of these watershed-based efforts (e.g., outreach/education, stormwater retrofits, etc)? Who has responsibility for implementing these watershed management plans?
    - What are the benchmarks being used to measure the relative effectiveness of these efforts?
    - What are these assessments revealing?
      ASK PHYLLIS

11. To what extent are shoreland zoning, stream protection overlays, or other zoning tools used to protect surface waters within your community? ***Have aquifer protection district, a wetland conservation protection district, floodplain development ordinance, Exeter shoreland protection district - recently updated the wetland and floodplains - revisiting them regularly to make sure they are right out there on the forefront.***

- If zoning tools are used, which water bodies are being protected and which tools are being used?
- Are these zoning tools proving to be an effective means of protecting water quality in your community and if so, how is this effectiveness measured or determined?
  Very effective, for example - shoreland buffer on Exeter River is 300 feet. New Regs are protecting vernal pools,

  Have structural and septic system setbacks that vary

12. How does your municipality currently pay for the operation & maintenance of stormwater infrastructure and what is the total operating budget including any allocations for capital improvements? ***General Budget. Rely on Development to maintain any systems put in on private land (swale, rain garden, drainage system in street) Even if the town takes over ownership of a road in a subdivision the swales still need to be maintained by the owner. If it's in the street, (storm drain) then maintained by the town.*** Are there any portions of the publicly owned stormwater system in your community for which the municipality is not responsible and if so, what are they?

13. Do these funding sources adequately cover stormwater system O&M and capital costs and if not has the community been able to determine the approximate funding gap?
    - Has your community considered other funding mechanisms (e.g., stormwater utilities, impact fees, compensation fee utilization plans)? ***Grant for dog waste program but otherwise all comes out of budget. If there is a Federal issue that needs to be addressed they get a warrant that is passed to fund it.***
      - Don't have enough money to clean out the storm drains. Would need to hire someone year round for two years to clean out the sumps of catch basins to catch up.

      She is a huge proponent of stormwater utility based on her experience in Seattle, where a small amount for each homeowner was able to fund so much more than they were able to out of general fund.

14. Does the municipality have enough understanding of its existing stormwater infrastructure to establish a process for considering or anticipating future infrastructure needs and associated costs? ***No***
    a. If so, what does this process entail and is there a related process for prioritizing needs?

Have they thought about watershed restoration? Funding it? ***Doesn't know if they would know what to do – where to begin? Would they need less impervious surface, wider buffers, how would they pinpoint***

Lewiston, ME Stormwater Program Development ~ November 15, 2010

Interview of Dave Jones, Jeff Beaule, Jan Patterson, David Hediger by R. Melanson & F. Dillon

Q1: Reasons for prioritizing SW management

- Prior to NPDES CSO/ CWA was the primary reason for addressing water quality issues. Jan Patterson (WQ Coordinator) was not on staff prior to NPDES
- Before NPDES permit…had Clean Water Act Master Plan…part of the CSO program, and was the true nexus for stormwater planning.
- No legal actions/ citizen groups saying "I want my stormwater clean"…regulatory driven (as a matter of fact now that we have the utility…many say they don't want their stormwater clean)
- The staff views of NPDES "thou shalt have a plan…"
- There were no legal challenges that spurred program
- Mostly trying to meet the minimums of the state and federal programs
- Became active when the "crackdown" was going to impact development

Q2: Options / approaches considered in response to regulatory requirements

- 2003 First NPDES
- CSO started in the 1980's
- Hired a consultant to look at the MCM (minimum control measures), and how they were going to meet them.
- 2003-2008 first permit started (CSO started in the 80s)…consultants helped draft plan that was submitted as part of the permitting requirements (as most communities)
- Discussed BIZIWIG and IZIWIG approach (collaborative) versus going it on their own…
- MS4 plan and annual report
    - Hired consulting engineers to develop a plan
    - Jan Patterson oversees NPDES permitting
- Not extremely proactive – Lewiston is trying to meet the minimum requirements of chapter 500 rules
- NPDES has seen changes in the rules as well as Chapter 500 in Maine…so the shifting rule changes create a difficult task for municipal staff to meet minimum standards…and impact development
- Attempted to be proactive (due to the writing on the wall that these rules would impact development), but met resistance

- Lewiston tried to include areas outside of the UI watershed to meet same standards (so that landowners on one side of the street did not have different rules than the other side of the street due to a "line drawn" watershed boundary)…did not fly…not well at all.
-
    - Planning Board in favor
    - Council did not like what they were hearing (heavy hand from the State)
    - Had Dave Ladd come into to talk about requirements, and what Lewiston needed to address…Council still not on board, CLF came to discuss potential consequences if Lewiston did not meet minimum requirements of the law, and finally the Council adopted minimum requirements (planning)
- Reluctantly meeting basic requirements

Q3: How SW program elements were identified

- Strictly based upon the MCM's
- 1999 Master plan (analysis and engineering)
- 10 year process – 3 year approval
- 15 year plan in 10th year (TMDL's/ 303d/ ch500)
- Misunderstand of the term elements…discussed this and DPW director believes that each program (CSO, NPDES, Urban Impaired Streams) stand on their own "their own fiefdom"…MCM's pull planners into the programs (CSO did not include planners…)
- Perceived result of this is that development occurs outside of these urban areas

Q4: How site specific development plans address SW considerations

- Delegated review authority (site and stormwater), solely placed in for economic development purposes
- Peer review (seen as "dueling engineers") only on major projects (major is not defined), Jan is the "peer review"…if the engineer specs meet the requirements great…not interested in re-engineering peoples projects.
- Jan does not calculate numbers in SW proposals…reviews overall plan, where water flowing, flow paths seem logical...etc. etc.

- DEP does not review stormwater permits, total disconnect…DEP is unaware of the permits Lewiston is approving (this contradicts SLODA, where you have to send copies of application and approval)
- Capacity/ quantity is more restrictive than Ch. 500
- No-Name pond watershed contains an overlay district where phosphorous standards are considered during the review…this has a "cumulative impact component"…
- Lake Auburn watershed has additional limiting factor standards for septic systems within the watershed
- Local ord is more restrictive in regards to quantity/ capacity (due to ch. 500 change)…this reflects the threshold of 1 acre disturbance under chapter 500…Lewiston reviews stormwater for capacity issues on every project regardless of disturbed area.

Q5: Municipal departments responsible for ensuring SW program compliance

- Primarily DPW (executes field program mgt.)
- Statement requiring 3rd party review in construction, statement from P.E. for as builts are needed prior to issuing a certificate of occupancy from the codes office.
- Erosion and sediment control is most of the enforcement issues
- City does not take ownership of stormwater treatment facilities
- Contingencies for fixing systems (add to tax bill, place lien on property)
- Jan speaks with local high schools about stormwater issues…

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

- Stormwater Utility embeds a "credit" available to property owners that do something above and beyond what the permit (state or city) requires…(ie: detaining more than 25 year storm)…it gives them a credit towards what their utility bill would be. Up until this language in the SW utility there was no incentive to go beyond permit minimums. Because of the fee people may be more encouraged to look into going beyond minimums.
- No real LID implementation
    - Not on horizon
    - No mandates
- Test cases with rain gardens and rain barrels…problem is that they cost $$$$

Q7: Process for establishing / implementing LID practices

Q8: "As built" certification process for SW BMPs

- As stated above, 3rd party inspection and statements

Q9: Impaired waters in Lewiston

- Hart Brook and no name pond
- Hart Brook planning effort (Pike and Granger involvement…?) (TMDL)
- Jepson Brook (TMDL)
- Stetson Stream
- Noname pond – river monitoring program (319) (erosion control on shore road)…City pays for testing within the lake
- "TMDL is not a funding mechanism…and quite frankly folks from DEP writing the TMDL's had never been to the brook before, and couldn't even find it!...who the hell wrote this, cause they don't even know where the hell this brook is"…"they gave us a study of the brook that 1. Wasn't even the brook, and 2. Didn't tell us anything…"
- Had CFUP…$200? Had a big amount in CFUP that got taken back out.
- Not executing a TMDL…

Q10: WMPs for impaired waters

- Hart Brook http://www.ci.lewiston.me.us/stormwater/hartbrook/index.htm
- Had small citizen group involved in this watershed planning
- No Name pond association (great assoc!) lake and brook monitoring program…very active group, that works with Jan Patterson

Q11: How zoning tools are being used to protect WQ

- No name pond watershed overlay district (phosphorus regulations)
- More restrictive in regards to quantity/ capacity (thresholds are flexible)
- TMDL's for numerous streams (Jepson, Stetson, Hart) (no approved TMDL's?)
    - Does not bring $$/ funding to address issues
    - Have yet to come out with recommendations
- Shoreland zoning (State Minimums)
- Resource Conservation District
- Groundwater protection overlay district
- Looking at making shoreland zone more flexible than it currently is (ie: frontage requirements in high density areas)
- Stormwater Utility…embedded in the utility is a credit that allows for

Q12: How SW program O&M and CIP are funded

- Capital improvement plan slowly addresses watershed management

- City implemented the SW utility due to a "tax crunch" back when Palesky proposed tax caps etc…city was looking to not raise taxes, and decided to move these SW costs from the general fund to its own utility fund. This in effect shifted some of the burden away from residential properties (as the utility is based upon impervious coverage) SF home=$44, Duplex=$66 non residential (including multifamily) pay base rate ($44 for first 2900 s.f… - .084 per sq. foot after 2900)…annual fee
- Local reporter coined it a "rain tax"
- $ 2 million budget
- Hart brook WMP would not have been funded out of general fund…utility fee paid for this…
- Utility pays for
    - NPDES
    - CSO (half is paid out of stormwater utility)
    - Legal/ administration
    - Debt Service
    - Bonds for SW improvements
    - O&M

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

- Jan manages the watershed management plans, as well as the CIP.
- Tries to pick away on an annual basis on things in the WMP
- No Name pond…association…public education

Q14: Adequate understanding of existing SW system to anticipate future costs

- Inventory has begun…not complete – GIS database…
- Existing infrastructure cap plan is for ten years…does not account for "treating" stormwater
- Jan thinks there is an adequate understanding in regards to maintain existing infrastructure…
- No asset management system set up…
- Fred: Any changes to the utility fee? Have had two changes since beginning (two rate increases)…
- Rod: Climate of working environment – new town manager…pretty good relationship between departments and council…

Future regs would cause future increase in rates…Not clear if process exists for prioritizing future SW program needs…

Manchester Interview – December 1, 2010

Present: Kevin Sheppard, PW director; Frederick McNeill, Chief Sanitary Engineer; Robert Robinson, Environmental Permits Coordinator; Pamela Goucher, Deputy Director for Planning and Zoning; Bruce Thomas, Engineering Mgt, Highway Dept.; Daniel O'Neil, Alderman at Large

K. Payson, & D. Roncarati

1. What were the reasons for making stormwater management planning a priority? For example, was the decision to establish a stormwater management program based on one or more of the following:

- Environmental concerns or considerations on the part of municipal officials
- State or federal stormwater regulations ***MS4 Federal requirements that pushed the city towards doing something.***
- Legal challenges directed at your community, or directed at other communities
- Citizen action/community pressure – ***The Alderman believes that flooding has driven the alderman to address stormwater. No public outcry that has pushed them on this.***
- A catalyzing event such as environmental emergency

CSO and Flooding: They are a combined system in Manchester so that comes in to play, as does flooding, which is always an issue in Manchester(Crosby Street area flooding). They are always looking to expand drainage in Manchester

2. 3min 12 sec
   If responding to regulatory requirements (NPDES or otherwise) in developing your stormwater management program, what options or approaches did you consider?

- Conventional regulatory approach (e.g., the 6 minimum control measures for stormwater programs required by regulatory agencies) ***6 min control measures were already being implemented – they have gone beyond this***
- Total Maximum Daily Loads (TMDLs) for impaired water bodies ***– Statewide bacteria TMDLs and they are looking at Phosphorous TMDLs for four of their ponds.***
- CSO abatement ***is an issue for them.***
- Watershed-Based Management Plans ***There is watershed restoration plan for Nutt Pond that includes install fore bays, wetland restoration, detention structures, stream dredged and restabilized it with 10foot diameter manhole with 4 ft sump that they are applying for a grant with in Dec 2010 to expand on it.***
- Low Impact Development practices –
- Others

Crystal Lake first(people swim there), then Doers Pond and now they are looking at Nutt Pond

Nutt Pond – they have installed fore Bays, wetland restorations, stream that they dredged and stabilize with a 10' diameter manhole to help capture sediment with a 4 foot sump.

Doors Pond – sediment loading is an issue so they are doing work up there. Crosby Street Intersection

- ***grant to help***

3. How were the elements of your stormwater management program identified, analyzed and selected (e.g., what was the process)?
Driven by state and federal regs – follow the 6 min control measures:

Started developing theirs in 2003, completed formal stormwater regs and ordinance by 2006

Bmp1: Outreach with local organizations, development community – developed pet waste brochure & kiosks at the ponds with info on pond work

Bmp2: HHW day 2x/yr – very successful, positive feedback from the public. Green Streets program, reduced price to install trees. In 2009 planted 79 trees. Developed stormwater hotline on city website

Bmp3: SW ordinance – investigate illicit discharge

Bmp4: Monthly basis goes to any job site to look for compliance. Mayors utility coordination meeting MUC meeting swip from contractors or their consultant ??

Bmp5: Manuals that developers can use

Bmp6: 14,000 catch basins – clean out every other year per state standard. Street sweeping 3x per year.

Having a positive relationship with contractors helps things go smoothly.

4. 26min In reviewing site specific development plans, how are stormwater considerations addressed? ***EPA issues construction general permits NH***
Because Manchester is already pretty much built out – most of the development is redevelopment. A lot of this is private development that are utilizing underground stormwater infiltration systems that are retaining the water. Because they are private systems, they aren't necessarily getting the same inspections that new development would. To counteract that, the city is withholding the CO until they are sure the stormwater system has been inspected. In some cases, pourous pavement for example, the Planning board is asking to see a copy of the maintenance agreement so they can be sure

Through local regulations

- If through local regulations, are they more or less strict than the state / federal regulations? ***City has their own regulations that are more stringent that the state***

By deferring to state / federal regulations

- Does your municipality have delegated review authority to issue stormwater permits?

Does your development review process focus only on impacts to water resources at the development site level or are cumulative impacts considered at the watershed scale? ***YES***
If other local watershed restoration efforts exist in your community, are the municipal stormwater standards consistent with these efforts?
Does your development submittal process include peer reviews?

Trying to put teeth in ordinance to maintain tree cover. Planning works hand and hand with PW and other depts. – look to see if there are any drainage issues already in the area – now there is a lot of redevelopment in the city. Now development is putting infrastructure underground infiltration systems. Require that the system is certified "as built". Developments now using pervious pavement and the city is concerned about longterm maintenance. – Trying to figure out what the right procedure is in place to make sure it is maintained.

-Lake Massabessic (the public water supply for Manchester) watershed overlay zone – covers the water source –some fueling stations were grandfathered, but otherwise no fuel stations. They are also bringing sewer lines out there - installing sewer line out there 25 million$$ collection system being phased in out there over 10 years to protect the watershed. – There is good cooperation between the departments

36' wide streets – public streets have been waived down to 30' and some as low as 24'. A lot of coordination with Hwy dept.

5. 45min 30sec Which municipal department(s) is / are responsible for ensuring stormwater management compliance? ***Hwy (public works), EPD(engineering), Planning – Planning's role is smaller – talking with developers to make sure they are aware of what they need to do – making sure that information is on the plans before they get started. Parks also has oversight of ponds.***
If multiple departments are involved with stormwater management, how well do these departments coordinate their respective activities? How does your community follow up on non-compliance issues? ***Most non-compliance comes from inspection sites, particularly smaller lots (less than one acre). Try to avoid non-compliance by setting up a safeguard in the beginning. C.O required. They aren't having those problems because of the inspection required and letter from engineer stating it works before the CO is issued. Also have systems set up so if they fail they back up on landowner's property so they have to deal with it. They require as-builts for public roads and public utilities – an acre or greater of public sites they require as-builts and bonds*** Are there any kind of enforcement procedures in place and if so what do they entail? Does your community require performance bonds or other contingencies for failing systems?

Planning role is to get things set in the first stage of set up – make sure owner understands their responsibility

Non compliance seen more at construction sites. EPA will be requiring as-builts for all development

Do require a bond until they see that all requirements are met. Planning collects the bond – but public works signs off on it. In conjunction with public streets – planning and public works sets that

90 private pump stations in Manchester. Some 6-7 houses, others up to 100. HOA are responsible for these and they are responsible for maintenance. The most problematic ones the town has taken over (there are 2 – and the city is replacing them now).

- To set the level of the performance bonds – Generally in conjunction with public streets - hwy dept develops the cost based on curbing, # of storm drains, pipes, catch basins, etc, plus a certain contingency is added to it. The town determines this figure rather than the developer's engineer.

6. Does your community require or has it attempted to use Low Impact Development stormwater management techniques as a means to mitigate the effects of development? ***Work with developers to suggest to use them. Find the LEED projects are more receptive. If snow storage is an issue on a development near wetlands, it has to be trucked off site.***

    - If not, why not (e.g., what barriers have prevented implementation of LID practices)? ***See it as private sector driven – elderly housing installed a rain garden.***
    - If so, what were the driving forces behind the implementation of LID practices (e.g., state / federal regulations, a catalyzing event, action from a local citizen's group, leadership from a government official, etc.)?
- If so, what types of LID practices or approaches have been implemented (e.g. swales, porous pavement, green roofs, rain barrels, ordinance provisions, etc.)?

Green roof at the city hall with sedums. They take samples of the soil on a regular basis to check for metal outtake. New public works and fire station will not be LEED certified.

7. If your community does employ LID practices, what was the process for establishing / implementing them? What role did / do educational materials play in the LID implementation?
    - What methods were / are used to disseminate this information and how effective have they been?
    - Who are the target audiences for the educational materials?
    - Did your community receive any kind of assistance (technical, financial or otherwise) from partner organizations?

8. Does your community have an "as built" certification process for stormwater BMPs / LID practices (e.g., a process for ensuring that stormwater treatment system plans accurately reflect what was ultimately constructed)?

Is the performance of stormwater BMPs / LID practices being monitored and if so, how does your community ensure that BMPs are functioning as intended?

9. Are there any impaired water bodies located in your community (i.e., urban impaired streams, lakes, rivers or other surface waters on the state's 303d list)? If so, what are they? ***Yes, on EPA website and they provided us a map with them on it. (NH DES provides these maps with all this data to all the MS4 communities.)***
EPA and DES created the list, but Manchester samples the ponds 3x during the summer. Goes along with the state 303d list.

    - Have TMDLs been approved for any of these waters? ***Statewide TMDL for Bacteria set by the EPA. 4 ponds have draft phosphorous TMDLs – - will happen over the next year. 12 ppb for total phosphorous – which will be tough to meet.***
    - If so, which waters have TMDLs and what are the pollutants of concern?
    - If TMDLs have been developed, have they proven to be an effective restoration tool?

    ??

10. Have or are watershed management plans being developed for any of these water bodies (or for any "non-impaired" water bodies)? ***Nutt Pond – EPA loves their management plan – they are applying for another grant to implement more of that restoration plan. Watershed district controls the massabesic lake***

    - If so, what are the primary goals of each of these watershed-based efforts (e.g., outreach/education, stormwater retrofits, etc)? Who has responsibility for implementing these watershed management plans?
    - What are the benchmarks being used to measure the relative effectiveness of these efforts?
    - What are these assessments revealing?

    Rob

11. 1hr 15 min To what extent are shoreland zoning, stream protection overlays, or other zoning tools used to protect surface waters within your community? ***Since 2001 last significant overhaul of city zoning ordinance. Own a lot of land around the lake. Increased setback to 25' for wetlands – used to be 4 ft.***
    - If zoning tools are used, which water bodies are being protected and which tools are being used? ***Massabesic overlay zone for drinking water and state statutes for shoreland protection.***
    - Are these zoning tools proving to be an effective means of protecting water quality in your community and if so, how is this effectiveness measured or determined?

12. How does your municipality currently pay for the operation & maintenance of stormwater infrastructure and what is the total operating budget including any allocations for capital improvements? **CIP budget that covers stormwater capital projects. Street reconstruction funds $750,000 goes to stormwater utility (both minor capital and maintenance) comes out of General fund. + some CDBG block grants and large capital projects can gets bonded.**
- Street sweeping and catch basins – line item for chronic sewer and drain CIP with roughly $50k/yr

    Are there any portions of the publicly owned stormwater system in your community for which the municipality is not responsible and if so, what are they? ***No – just private developments that are not part of the system.***

13. Do these funding sources adequately cover stormwater system O&M and capital costs and if not has the community been able to determine the approximate funding gap? ***NO***
    - Has your community considered other funding mechanisms (e.g., stormwater utilities, impact fees, compensation fee utilization plans)? ***New TMDL will help make the case. They have determined who is in and who is not ? Stormwater utility is 80%+ the way there. They have the data base ready and could send out 30,000 SW utility bills tomorrow if it was approved by the mayor.***
    - ***State house bill 1295 – statewide commission who is considering a statewide run stormwater utility - has to go in front of the Gov. and executive council. Towns could opt out if they wanted. Search EPA stormwater Utility.***
    - ***Manchester would like to be the first SW utility in NH, Dover is probably the only other closest community to implementing one. If they hadn't gotten a new mayor when they did, it probably would have passed in Dec 2009.***

14. Does the municipality have enough understanding of its existing stormwater infrastructure to establish a process for considering or anticipating future infrastructure needs and associated costs? ***The department does, elected officials pretty much do, but what about the citizens, do they have enough understanding to further fund SW infrastructure? Citizens are seeing results from the CSO phase 1 – they have an extensive public awareness campaign and really try to sell their successes to the public.***
    They have a sophisticated GIS system – "view works" software for attribute storage.

    a. If so, what does this process entail and is there a related process for prioritizing needs?

NH has 3 state stormwater organizations – coalitions with meetings every other month – Manchester and SeaCoast coalitions are the two most active. Plastow, one of the towns in their group didn't join until after they were fined. The DES encouraged Plastow to join. They work together to help solve some of these problems.

Portland, ME Stormwater Program Development ~ November 15, 2010

Kathi Early, Doug Roncarati, David Margolis-Pineo, John Emerson, Phil Dipierro, Alex Jaegerman, Molly Casto

by R. Melanson & F. Dillon

Q1: Reasons for prioritizing SW management

- "All of the above"
    - Environmental concerns…city views itself as environmentally conscious (sustainability plan)
    - Mandates from above
    - Legal Mandates - lawsuit with CLF to uphold responsibilities (consent agreement in regards to CSO separation projects) – Baykeepers – citizen actions…friends of Casco bay – interested in ensuring the city is "doing the right thing" – community expectations
    - Funding and financial reasons…when state & federal regulations are imposed…in order to meet those, there is a funding gap…when developing a utility (SW infrastructure), identifying funding sources (currently using sewer fees to fund SW mgt).
    - Flooding issues …driving the CSO program…CSO pretended to address stormwater…(ie: designed culverts to 25yr events…after a particular year & flood, city moved to sizing to 100yr events)…
    - Catalyzing event to look at SW differently was a 319 grant…ended giving back, due to lack of public support. (mid 1990's)
    - Driving force of trying to keep Portland ahead of the curve was/ is the Long Creek issue – working with DEP to avoid remediation action enforced by Feds, which may be very detrimental to the city and landowners…projected $$$ to be in compliance is daunting in all watersheds in Portland…how do we accomplish this goal? (may lead to utility development)
    - Phase 2 permitting…city began to take SW more seriously (realizing it was different than the sewer abatement program)
        - Fred: Q about regional SW utility…A – SW knows no boundaries…so regional response makes sense…long creek example…and plan is a good model of this. Shared resources – technology – information…equipment and billing etc etc

Q2: Options / approaches considered in response to regulatory requirements

- Alternatives analysis was undertaken under the premise of "how do we <u>not</u> do this alone"
- Build something regional
- Able to convene working group with the DEP at our side
- Developed a 5year plan of attack with the regional working group (isiwig)
- Felt as though we were forced to plan with no $$ support…
    - SWCD was working on hazard/ flood planning…which served as a catalyst to form this working group

- Program was developed around the 6 minimum TMDL, which have occupied us so much that we have not been able to consider alternatives
- Well..alternatives may have been considered, but have not been analyzed or accomplished
- We are caught up in the regulatory approach…which hinders a holistic planning approach
- Created accounts for SWM, created a position to coordinate SWM
- Goal is to be more watershed based
- Started looking at the greenbelt plan in capisic brook

Q3: How SW program elements were identified

- As program was being built it had to be justified
    - Accounting and policy questions revolved around financing
    - City mgt critiqued financing, but ultimately approved program approach
    - Sewer user fee ($$ used for SWM)
- Fees are now onerous
    - There will be resistance to increases…"fee is tapped out"
- Beyond internal budget discussion ids the council adoption of MS4 discharge permitting and planning
- IZIWIG began process:
    - Maximize what was being done
    - Implement bare minimums for compliance
- Received authorization from city council to adopt 5 year plan with DEP
- Process is budget based

Q4: How site specific development plans address SW considerations

- Delegated review authority (site and stormwater)
- Updated local ordinance to reflect DEP chapter 500…every project review must recive chapter 500 permit (according to the state thresholds)
-

Q5: Municipal departments responsible for ensuring SW program compliance

- School/ facilities department – DPW – Planning
- Performance guarantee requirement
- Before a certificate of occupancy…inspection of site is conducted

- Enforcement:
    - Permit withholding
    - Stop work order
    - After fact review
    - Violation actions
- In house inspection of all public work
    - Third party review as well
    - BMP's are always inspected
- Most contractors repair BMP violations…City contacts DEP with any ongoing violations
- Stormwater discharge ordinance
    - Identifies what is allowed to be discharged and has enforcement mechanisms
- How to respond to mock "disaster" – how do address major spills?

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

- LID buy in is important…the question is how do we build them in
- Data needs…
- There is progress being made with LID, but it is not built into the code
- Ocean ave elementary school (raingardens, maintenance plan, roof garden)
- LID is still a learning process…for those who work in the field as well as the public
- City development review standards
    - Talked about adding LID standards (never embedded)
    - Reviewed where we were actually prohibiting the implementation of LID
    - Maintenance questions
        - How do we manage a decentralized system?
        - What mechanism is needed to deal with that
- LID along Bayside trail

- SW utility should build in credits for LID

Q7: Process for establishing / implementing LID practices

- CDC wanted LID education
    - NEMO did a presentation
- Workshops have been conducted about Long Creek watershed planning
- CSO workshops
- Multiple committees need to work together in Portland…cross education opportunities for LID/ SWM

Q8: "As built" certification process for SW BMPs

- ?

Q9: Impaired waters in Lewiston

- 5 water bodies (see Doug)

Q10: WMPs for impaired waters

- Capisic Brook (Doug)

Q11: How zoning tools are being used to protect WQ

- Portland is compliant with Shoreland rules…worked with DEP in developed areas to relax some standards
- Language being drafted to further protect streams
- Data for identification…does area deserve better protection
    - Develop criteria
- Ch. 500 – and site plan standards
- Land bank Commission (tool for resource protection…$50,000/ yr)
- FIRM floodplain zoning
- Technical manual (referred to in zoning) (?)
    - Wetland standards

Q12: How SW program O&M and CIP are funded

- Utility is likely, but not happening at the moment
- Develop stakeholder process…and bring it (utility) to the ordinance level
- Proposal will likely be tied to 2011 CSO tier III
- Exemptions will come up
- New costs will emerge
- Education needs to occur
- Separate the costs of CSO and SWM
    - Accounting (ie: street sweeping)

  - Track costs through "city works" database management system
- Starting to develop data magt.
  - Need good accurate mapping
  - Clean up of infrastructure data set
  - LID implementation will be plotted, mapped, and tracked
- Work order tracking system
- Pilot in capisic brook watershed
  - Mapping (crytstal reports, system maintenance #'s)

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

- Working toward breaking out SW & CSO costs
- Basic level cost anticipation
- Over the3 last handful of years capital $ has been to CSO
  - SW program has taken back seat to CSO
- Financially driven by CSO demands

Q14: Adequate understanding of existing SW system to anticipate future costs

- Challenges are understood
- Change in governance – unknown
- Proactive planning and implementation that address the issues
- Monitoring of existing and future action steps
- Drainage maintenance authority (?)

2 years time CSO will shift…

Portsmouth, NH Stormwater Program Development ~ 3/4/11

Notes from Phone Interview of Silke Psula by F. Dillon

Q1: Reasons for prioritizing SW management

- Ultimate catalyst was regulatory but also based on recognition that City has responsibility and cares about environment.
  - Activists / advocates / resident perception and demand also played important role
  - Decision also largely based on financial considerations
  - People in the "dugout" understand problem, but it takes financial incentive to make stormwater management a greater priority
  - Disconnect in understanding about what folks are getting for clean water

Q2: Options / approaches considered in response to regulatory requirements

- City took conventional / MCM-based approach following EPA's issuance of NOI (Notice of Intent) in ca. 2003
  - Fine print of EPA's action also includes provisions for TMDLs, 303d listings, identifying impairment sources / types, etc.
  - Also results in w'shed / MS4 communities banding together to consider SW management concerns
- City does have TMDL(s?) for bacteria; didn't ask if TMDL(s) exist for other pollutants – only Little Harbor has a TMDL. For details you can read the report at http://des.nh.gov/organization/divisions/water/wmb/tmdl/documents/little_harbor_final.pdf

Q3: How SW program elements were identified

- As determined by federal / state requirements
- More work still needed to make connections between MS4 program activities and actual WQ improvements

Q4: How site specific development plans address SW considerations

- Technical Advisory Committee meets monthly to review projects – includes reps from all City departments

- Ordinance (section 10.1018.10) includes stormwater provisions which refer directly to NHDES SW Manual, so City relies primarily on state regs for SW management
    - Also see section 7.4 of Site Plan Review Standards (beginning on p. 36)
- Developers submit SW plan and staff conducts review
- Portsmouth is pretty well built out, so most projects are for redevelopment
- An IC map developed ca. 2000 sets total imperviousness at 27%
- The Great Bay National Estuarine Research Reserve is involved with City's efforts to address SW concerns
- Didn't ask whether there is a peer review process – not that I am aware of

Q5: Municipal departments responsible for ensuring SW program compliance

- Primary reporting / documenting compliance / details of requirements responsibility for SW program resides with Silke
- DPW maintains SW and sewer infrastructure
    - Portsmouth has CSOs and is putting considerable effort into separating them
- Planning Dept is also involved through the site development review process
- City is currently improving non-compliance review and enforcement procedures
- Didn't ask whether performance bonds are used to fix failing systems – depends on the project. Revolving fund is more frequently used. Also Portsmouth is looking at a significant rate increase this year.

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

- LID is being promoted by Planning Dept. on a voluntary basis
- More difficult to implement with redevelopment projects
- Portsmouth was identified as an "Eco-Municipality" a few years ago, which is consistent with LID concepts and practices
- Fire station and library built to LEED standards

Q7: Process for establishing / implementing LID practices

- Have programs to promote use of rain barrels and rain gardens, which serve as good demonstration projects
    - Government partnership with private landowners to promote LID; NHDES has been instrumental in this effort
- Demonstration projects on both public and private properties with porous asphalt, rain gardens, rain barrels
- Developed brochure and other PSA materials (including website)
- City conducts ed & outreach activities with local schools
- AMEC recently contracted for SW Feasibility Study (refer to Workshop #1 Meeting Summary Notes from 5/19-20/10). Project has stalled due to negative events in Dover. Presently working on how to move forward. The project is about ½ complete with linchpin on workshop 2 with the public and preparing final draft report.

Q8: "As built" certification process for SW BMPs

- Developers are supposed to submit as builts (or record drawings); currently occurs on occasional basis and City recognizes need to conduct more follow-up
- Didn't ask about monitoring for BMP performance / maintenance – there is room for improvement with follow up monitoring

Q9: Impaired waters in Portsmouth

- All waters in City are considered impaired for a variety of pollutants (NHDES 2010 303d list identifies 14 separate water bodies)
- Little Harbor has bacteria TMDL for which Portsmouth comprises only a small portion of the w'shed
- NHDES hasn't developed TMDLs for IC / urbanization (but may be considering it?)
- Changes to CSO made it easier for City to comply with terms of TMDL
- Still uncertain how effective TMDLs will be at improving WQ given difficulties in determining extent and nature of improvements

Q10: WMPs for impaired waters

- Currently no WMPs

Q11: How zoning tools are being used to protect WQ

Not closely involved in development review process and suggests review of local ordinance for more info (see links above in Q4) - New Zoning Ord., updated and passed Jan 2010, and are considered progressive – specifically addressing quality of surface waters and ground water by controlling the rate and volume of stormwater runoff; preserving the ability of wetlands to filter pollution, trap sediment, retain and absorb chemicals and nutrients and produce oxygen; and to prevent the destruction or significant change to wetlands.

These requirements incite landowners/developers and contractors to work collectively for good alternatives and solutions, proposing BMPs for stormwater control incorporated in their request for developing properties.

Q12: How SW program O&M and CIP are funded

- Dover and Portsmouth commissioned utility study (AMEC) and Portsmouth did SW Master Plan in May 2007 (Kristi Rabasca with Edward and Kelcey)
- CIP does not include CSOs since this would likely overwhelm the utility
- AMEC did SW utility study and Kristi Rabasca did Service Analysis Rate Model

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

- Funding is not currently adequate and other mechanisms will be needed
- Have pretty good idea of current SW program costs through work done by Kristi (see Q12)
- Still need to educate staff and Council on importance of establishing an adequate funding source for SW program

Q14: Adequate understanding of existing SW system to anticipate future costs

- DPW has fairly good sense of system's condition and conducts TV inspections of lines to enhance understanding
- 2007 SW Master Plan included inventory and mapping of SW system that identified maintenance priorities

Stormwater Management in Northern New England

South Portland Interview 10/27/2010

Participants: Pat Cloutier, Fred Dillon, Charles "Tex" Haeuser, Steve Puleo, & Dave Thomes

Question 1 –

- Pat: When NPDES Phase I stormwater regulations were implemented for large MS4 communities, he knew it would not be long before smaller communities would be required to address their stormwater pollution problems
- Dave: We researched Phase I communities to gear up for this inevitability; It helped to have familiarity with wastewater regulations & permitting, unlike some smaller communities that did not have any experience with water quality regulations
- Pat: The Long Creek watershed planning process was initiated because development in the Maine Mall area, with its 70 stormwater outfalls, was an obvious target; If property owners were required to obtain permits and install costly treatment retrofits, businesses might decide to relocate; Wanted to work with these landowners to avoid this; The CLF was also turning its attention to the watershed increasing the pressure to act to avoid heavy-handed regulation
- Tex: Long Creek provided the impetus to start overhauling our zoning, wetlands, & stormwater management regulations; A NEMO presentation provided some useful information
- Pat: The Planning Dept really embraced the need for better stormwater management, while Waste Water & Water Resources were less enthusiastic
- Steve: We saw zoning as a good venue for stormwater management & noted that prior to this effort, stormwater infrastructure was not accounted for or inspected to ensure it was working
- Fred: Staff was proactive
- Dave: Pat kept the City council aware of developments related to stormwater management practices & let them know that significant changes were coming
- Pat: We changed our department's name from Pollution Abatement to Water Resources & Pollution Control
- Fred?: Public Works used to maintain the sewers & storm drains, but the newly created Dept of Water Resources & Pollution Control took over management of all underground infrastructure

Question 2 –

- Dave: First & foremost we designed our program around meeting the MS4 General Permit's six Minimum Control Measures (MCMs); TMDLs were incorporated into the program as they were developed for specific watersheds; Watershed management plans (starting with Long Creek) became another focus; Looked at opportunities to promote LID, noting that the SP Conservation Commission got a grant to develop an LID manual for New England Coastal Communities.

- Fred: We concentrated on meeting the six MCMs and where possible, tried to do more than the minimum

Question 3 –

- Pat: We started participating in the ISWG which promoted a regional approach to stormwater management and explored opportunities for working together to meet this challenge; What role can we play?; Cumberland County Soil & Water Conservation District was a real leader in this effort
- Dave: Started having the wastewater guys attend (Pat & Dave) since they already had experience with permit issues, while other communities were sending staff that were unfamiliar with wastewater discharges
- Tex: Water Resources Protection consciously began framing the program while the CLF provided the driver by pushing the Long Creek issue; The Zoning Committee promoted development/revision of the ordinances
- Steve: South Portland tied the Chapter 500 regulations to the municipal ordinance to make it easier for developers to meet state and city stormwater regulations
- Tex: The city didn't adopt specific approaches to LID, but supported development of an LID manual for coastal communities (in Northern New England) by the conservation commission with the support of the CBEP
- Steve: Staff researched LID and were open to the use of new BMPs; Promoted alternatives to traditional stormwater management but did not require them [Pat noted that at first it was difficult to require the use of LID practices because the ordinance did not push for it]; Partnered with and relied heavily on MeDEP to approve BMPs; South Portland served as a testing ground for stormwater BMPs for MeDEP
- Dave: Every development project requires much back & forth negotiation between city staff and the client's engineer, but both Pat & Tex reminded that their first obligation is to make sure that the project meets the ordinance
- Steve: Until the ordinance was changed to allow for greater flexibility in handling stormwater runoff, an ordinance waiver was required for any alternative stormwater management technologies
- Pat: Noted that there are many forward thinking developers willing to consider or use LID and "green' BMPs; but for the most part they have had to frighten developers into addressing stormwater management issues upfront in the development review process rather than wait until regulators forced them to make costly upgrades.
- Tex: Noted that development of their GIS was key to managing their stormwater management programs

Question 4 –

- South Portland does not have delegated review authority from the MeDEP, but they do enforce a lower threshold than MeDEP
- Steve: Most projects they see are "redevelopment" projects where the developer already has a MeDEP Site Location of Development permit

- Steve provided examples of how their ordinance addresses various levels of stormwater management: Residential house sites require a basic drainage plan down to the building permit level (even a 5,000 sf structure) & is reviewed by a consulting engineer; At the site plan level, the developer must meet Basic Chapter 500 standards for projects of 1,000 sf or more and a stormwater management plan & maintenance agreement is required; A minor site plan requires a stormwater management plan while a major site requires a post-construction stormwater management plan as well

Question 5 –

- Dave: Water Resources Protection manages the program and has most of the enforcement authority; Planning provides some oversight of new development and the two departments collaborate on tracking projects
- Steve: Code Enforcement ensures that new stormwater systems are installed properly & function as designed; third-party inspectors are required for large projects although in-house inspectors are often used for minor projects; The Stormwater Program Coordinator might also conduct site inspections
- Pat: Water Resources Protection takes on oversight of post-construction stormwater management practices with assistance from Planning, Code Enforcement, Public Works and to a lesser extent, Fire, Police and other departments
- Steve/Fred/Dave: Noted the MS4 requirement that owner/operators of post-construction BMPs must submit annual reports and staff must follow up to make sure that the repairs and other maintenance activities were performed

Questions 6 & 7 –

- Yes, the municipal ordinance requires consideration of LID
- The LID manual for New England Coastal Communities being developed by the South Portland Conservation Commission will be a great tool for developers , engineers, & homeowners; Funded by Casco Bay Estuary Partnership ($22,000 grant) and the State Planning Office's Maine Coastal Program ($10,000 grant); The Planning Dept. will need to promote the use of this new tool

Question 8 –

- Yes, developers must submit a geo-referenced "as-built" plan set and a GIS version of the completed project; Performance bond is not released until these are submitted

Question 9 – ***Verify through Fred***

- Portland has five Urban Impaired Stream watersheds: Long Creek, Barberry Creek, Trout Brook, Red Brook and Kimball Brook

Question 10 – ***See Fred***

Question 11 –

- Steve: Shoreland Zoning & the Stream Protection Overlay Districts are important tools for protecting the streams
- South Portland has three Stream Protection Overlay Districts:
  - SP1 – Applies to Trout Brook & Kimball Brook and consists mainly of FEMA flood plain area plus some additional areas,
  - SP2 – Applies to the Western part of the city including Long Creek & Red Brook and includes a historical 100' no development buffer that has been modified with zoning changes to a 75' setback but the additional 25' still needs to be preserved to meet shoreland zoning requirements,
  - SP3 – A 100' buffer applies to minor tributaries mapped according to morphology including those that are steep narrow
- Shoreland Zoning includes a Resource Protection Overlay District that conforms to the 250' shoreline area under FEMA
- Steve: Noted that existing development and some new projects could get a zero-foot setback if they obtain MeDEP & NRPA permits

Question 12 – ***Verify***

- The Sewer User Fund pays for about half of the stormwater budget (around $340,000)
- Difficult to track stormwater-related costs associated with other departments
- Unsure of the stormwater-related costs covered by the Capital Improvements Plan
- About $60,000 for implementing the Long Creek Restoration Plan comes from the Sewer User Fund
- Looking at the possibility of using stormwater impact fees to defray some of costs of making capital improvements to the stormwater management system

Questions 13 & 14 –

- South Portland has a 10-year CSO abatement program funded through their Capital Improvements Plan
- Starting to get a handle on the individual costs of different stormwater management tasks
- Water Resources Protection is looking at how to depreciate their stormwater assets and develop an enterprise fund/stormwater utility for managing their stormwater system
- Pat: Their GIS allows them to perform modeling and their asset management software and SWM model can be used to predict system failures and upgrade/maintenance needs; South Portland does not have a GIS department: It was developed by a consultant with a collaborative effort between Water Resources Protection and Planning

Final Comments –

- Working together and assembling the resources is the key
- Noted that the Planning & Development Department is under the prevue of the City Manager's Office, which helps ensure that these key elements happen

S. Burlington, VT Stormwater Program Development ~ 2/24/11

Notes from Phone Interview of Tom DiPietro by F. Dillon

Q1: Reasons for prioritizing SW management

- 5 impaired streams in City
- TMDLs / cost of compliance
- Compliance with MS4 permit
- Aging / older infrastructure
- SW program has been in place for 6 years; Tom's been there for 5 of them

Q2: Options / approaches considered in response to regulatory requirements

- TMDLs and MS4 requirements
- TMDLs established targets without implementation plan
- New MS4 permit will require development of WMPs
- Can't use 319 funds to meet existing permit conditions
- Provides regulatory reason to assist towns with SW program needs

Q3: How SW program elements were identified

- By estimating costs to remediate problems (e.g., MS4 compliance and capital improvements)

Q4: How site specific development plans address SW considerations

- Local requirements generally refer back to VT's SW Design Manual
- In addition, a local SW management overlay district has been established with more requirements than state
    - Bartlett Brook w'shed is an existing overlay district established to control SW runoff and reduce erosion problems

  - IC-based with fairly small area and little opportunity for redevelopment
  - Focused on LID practices
- Draft MS4 permit will require flow reduction and may result in expansion of overlay district
- TMDL implementation / draft MS4 permit requires w'shed scale restoration and 10 year time period to implement all BMPs
  - There are some questions as to whether 10 years will be long enough to attain compliance with WQ standards. For example, Potash Brook retrofits are estimated at ~$25M and it's unlikely that sufficient funding can be generated in the 10 year timeframe.
- Local restoration efforts (e.g., soon-to-be started stream team and inter-municipal consortium of regulated MS4s) are consistent with state / federal SW program requirements (MCMs 1 and 2) but unclear on how they might relate to local regs
- Development review first done by Planning Dept and then by Tom

Q5: Municipal departments responsible for ensuring SW program compliance

- Primary responsibility for SW program resides with DPW and Planning, which both work well together
- Before Certificate of Occupancy is granted, Tom inspects applicable new development / redevelopment projects for SW BMPs; ESC inspections are done opportunistically
- Performance bonds aren't required and it's never really been an issue.

Q6: LID methods / techniques to mitigate adverse effects of development on WQ

- Overlay district requires meeting certain post-development flow rate, which results in LID by default
- Flow rate reduction better achieved through larger projects since rain barrel and rain gardens aren't as effective
- Cautionary tale: curb-cut bioretention project in upscale n'hood resulted in considerable push-back and ultimately had to be abandoned.

Q7: Process for establishing / implementing LID practices

- Demonstration projects on both public and private properties with porous asphalt, rain gardens, rain barrels

- Public workshops and flyers / PSAs with quarterly bills
- Front Porch Forum: Community Newsletter
- Target audiences are primarily residential with business community to a lesser extent
  - SW utility will take over residential properties but not businesses
  - AMEC developed SW utility

Q8: "As built" certification process for SW BMPs

- No "as built" certification process per se, but somewhat addressed through Certificate of Occupancy process.
- City is responsible for inspecting all BMPs and offers credits to property owners who install them

Q9: Impaired waters in S. Burlington

- 5 urban impaired streams in City
- City has (2?) EPA-approved TMDLs for Bartlett and Potash Brooks; TMDLs have not proven to be very effective at restoring WQ

Q10: WMPs for impaired waters

- There's currently a general WMP for the City; separate WMPs will be developed for each of impaired streams (confirm with Tom)
- Ultimate goals for all WMPs will be eventual attainment of WQ standards.
- MS4 communities and SW utility will be responsible for implementing WMP recommendations
- Benchmarks for determining implementation effectiveness will be WQ and flow monitoring and state's decision support model (BMPDSS)
- Too early to say whether BMPs are making a difference

Q11: How zoning tools are being used to protect WQ

- River overlay, buffer requirements, SW overlay, wetlands protection

- All good first lines of defense

Q12: How SW program O&M and CIP are funded

- IC-based SW utility that currently generates $1.3M per year and will increase to $1.7M in near future to account for CIP costs
- Single family = $4.50 / month
- Commercial properties = total IC / 2700 ft2 = equivalent residential unit

Q13: Adequacy of current SW program funding and estimated gap to fully fund needed O&M / CIP

- Funding is currently adequate but probably won't be for new TMDL requirements
- Other funding sources sought through grant applications

Q14: Adequate understanding of existing SW system to anticipate future costs

- Yes as supported by good GIS database of system, which is just beginning to incorporate TV inspection
- They have a good sense of what needs to be replaced and are making improvements through CIP process