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I. Introduction

Communities engaged in stormwater issues face a complex landscape of public objectives, constituencies, and constraints. While social marketing techniques have been used successfully across the nation in stormwater awareness, education and behavior change campaigns, especially as communities work to fulfill the requirements of EPA's Phase II Municipal Separate Storm Sewer System (MS4) rule, social marketing also shows promise for transfer beyond the typical school-based or local audience into arenas with different constraints and objectives.

Affecting behavior change around stormwater management at other decision-making levels, particularly when money is at stake, requires careful adaptation of social marketing techniques and a special focus on *scale*: the scale of the target audience, financial implications, geography, and decision-making process involved. The three-part regional, local and neighborhood education campaigns underway in Chittenden County and the City of South Burlington, Vermont show how the creative adaptation and scaling of social marketing techniques can go well beyond conventional education for behavior change. Particularly at a neighborhood level, social marketing techniques can be used to introduce whole-systems thinking about stormwater management.

Whole-systems thinking, which has been expressed as "...a process through which the interconnections between systems are actively considered, and solutions are sought that address multiple problems at the same time[1]," is often lost in the pressure to meet stormwater permit standards, minimize per-unit costs, avoid regulatory complications, and

[1] Wilson, Alex et al., Green Development: Integrating Ecology and Real Estate. Snowmass, Co: Rocky Mountain Institute, 1998.

simplify issues for the public. Typically used in the same context as "sustainability," and most often applied to regional issues around resource consumption, the whole-systems objective of finding solutions that address multiple problems can apply directly to local stormwater financing, regional coordination, stormwater system design, and notably, decision-making around localized stormwater management approaches.

This paper outlines the regulatory context, public objectives, and social marketing techniques being used simultaneously at regional, municipal and neighborhood scales and the implications for whole-systems thinking: (1) the Chittenden County Regional Stormwater Education Program (RSEP), which has gained national acclaim as an innovative and cost-saving inter-municipal approach to meeting MS4 education requirements; (2) establishment of Vermont's first stormwater utility in the City of South Burlington; and (3) the joint University of Vermont-City of South Burlington "Redesigning the American Neighborhood" (RAN) project in the Butler Farms neighborhood, which is evaluating the social acceptability and environmental outcomes of different scales of stormwater management approaches in a neighborhood facing an expensive stormwater system upgrade. The paper evaluates how issues of scale have affected program design and outcomes, and summarizes implications of the lessons learned for increasing systems thinking and providing more meaningful public engagement in stormwater management.

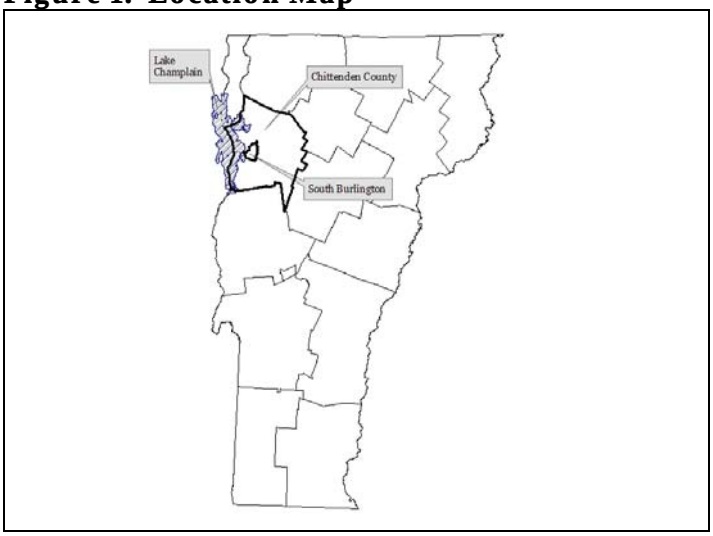
II. Project Setting: Chittenden County and South Burlington, Vermont

A swirl of high-profile lawsuits, legislation, municipal activity and regulatory changes has made "stormwater" a household word for the 141,000 residents[2] of Chittenden County, Vermont (Figure 1) between 2001 and today. This highly complex political

[2] Data based on the U.S. 1997 Economic Census and City of South Burlington data.

situation, which received extensive media coverage, largely defined the initial information needs, and behavior change objectives of the three education and outreach programs.

Figure 1. Location Map

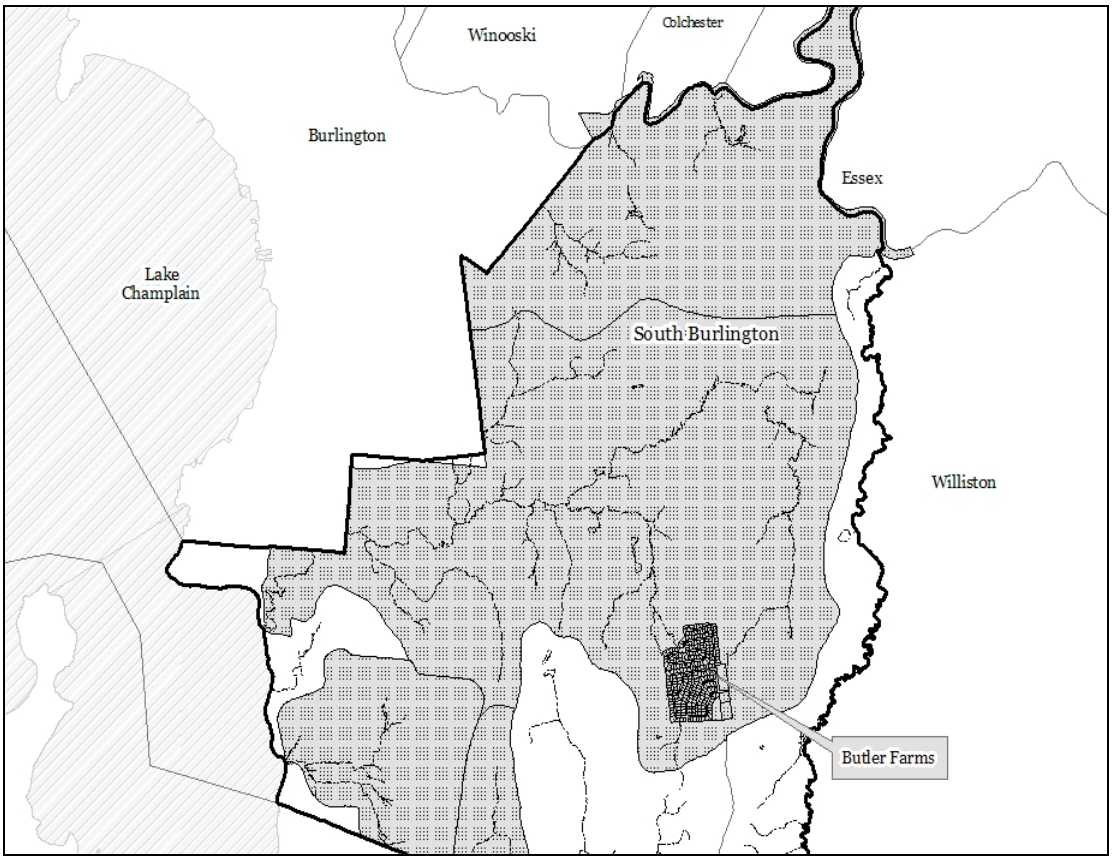


Home to 23 percent of the state's people and jobs, and most of the area subject to the EPA Phase II MS4 rule, Chittenden County also has more than its share of Vermont's urban stormwater management problems. The County is home to nine of the seventeen streams on the State's 303(d) list of waters impaired by urban stormwater runoff (Figure 2). Most of these streams discharge directly into Lake Champlain, prized for recreation and the drinking water source for most of the County. The Lake's phosphorus TMDL attributes roughly 30 percent of the nonpoint source load to runoff from urbanized land in Vermont[3].

The *Lowe's* Case: As of 2001, when the State began gearing up to implement the Phase II rule, no TMDLs had been prepared for these impaired waters and over 1,000 state stormwater discharge permits had expired - most without notice to the property owners. As a result, Chittenden County and especially the City of South Burlington became the epicenter of a political and legal crisis in June 2001 when the Vermont Water Resources

[3] Lake Champlain Phosphorus TMDL. Vermont Department of Environmental Conservation and New York State Department of Environmental Conservation, September 25, 2002, Fig. 2, page 5.

Figure 2. Stormwater-Impaired Watersheds in South Burlington & Location of Butler Farms



ruled that no new or increased discharges of pollutants could be added to any impaired waterway without a TMDL[4]. This ruling, known as the *Lowe's* case, halted stormwater permit issuance and renewals in impaired watersheds, stalled many property transfers and developments, and set off a multi-year legal and legislative process to clear the expired permit backlog, develop TMDLs, and clarify permit standards for new development.

Regional Stormwater Education Program: About the same time as the *Lowe's* case was decided, public works managers and planners from the municipalities and other agencies subject to the Phase II MS4 permit (notably Burlington International Airport and the Vermont Agency of Transportation) were meeting monthly to discuss implications of

[4] In re: Hannaford Bros. Co. and Lowes Home Centers, Inc., Docket No. WQ-01-01, Memorandum of Decision. Vermont Water Resources Board, Jun. 29, 2001.

the Phase II permit. There was a shared concern that if handled locally, public education and outreach compliance might consist only of local officials reprinting EPA brochure templates. This was not seen as an efficient or effective use of money or time.

From this shared concern arose the concept for an inter-municipal agreement to develop a regional education plan, funded jointly by all of the permittees, with the professional resources and capabilities to accomplish an effective campaign. There was strong support from the legislative bodies of all of the permittees, as well as the Agency of Natural Resources, and through a Memorandum of Understanding the RSEP was established in January 2003. Funding was done on a formula basis with each permittee contributing an annual amount equal to what the State estimated would be required to meet the permit condition individually. This yielded a five year budget of $250,000.

Through a competitive bid process, a consulting firm with strong media and social marketing expertise (as opposed to environmental advocacy or municipal government experience) was chosen to prepare a five-year strategy, including pre- and post-program surveys to help define target audiences, desired behavior changes, barriers, motivators, and measures of success.

South Burlington's Stormwater Utility: Also at the same time, the City of South Burlington had begun exploring a municipal stormwater utility to deal with its unique land use environment. South Burlington, with 17,000 residents, is Vermont's fifth-largest municipality and its fastest growing by far, with an annual average of 250 new housing units and a burgeoning employment base. Home to Burlington International Airport, Vermont's largest regional shopping mall, and six miles of public roads per square mile of land, the City also contains all or part of six impaired watersheds and over a quarter of the State's expired stormwater permits.

Faced with the pressing need for a stable and robust funding stream to deal with back-logged capital projects and increased maintenance requirements, and a desire on the part of the City Council and staff to do watershed planning in a more integrated manner than the State was proposing, the City spent three years studying its stormwater management options. In March of 2005, amid the regional education and outreach campaign, the City Council established Vermont's first stormwater utility by ordinance, with a fee of $4.50 per month per equivalent residential unit (ERU)[5]. The ordinance survived Vermont's thirty-day public appeal period unchallenged, and billing began in July.

The utility offered a critical carrot to City homeowners affected by the *Lowe's* case: The ordinance stipulates that any residential system that has been upgraded to meet current State standards can be taken over by the utility, regardless of the status of the system's State permit. The City's offer to place itself between individual residents and the State permit quagmire greatly increased the perceived value of the utility to residents. However, as the Butler Farms case is demonstrating, this policy also creates a strong incentive for homeowners and associations to upgrade stormwater systems to State standards as quickly and cheaply as possible, which may or may not be consistent with whole-systems thinking about watersheds and stormwater management options.

The Butler Farms Neighborhood: Stuck between the State's legal and permit tangle and the City's new utility were two dozen residential subdivisions in South Burlington whose residents gradually discovered, after *Lowe's*, that their homes are subject to long-expired State stormwater discharge permits, and that their systems do not meet current State standards. Butler Farms was one such neighborhood. This classic half-acre

[5] ERU refers to the average amount of impervious surface of a single-family residence (2,700 SF in South Burlington), with other properties charged based on the number of ERUs of impervious surface owned.

lot single-family subdivision of 253 homes is subject to two different stormwater permits (both expired), has no homeowners' association, and is plagued by localized flooding and stream quality problems. Problems with home sales in the wake of *Lowe's*, frustration with flooding, and confusion about the relationship between the City's utility and the State permit impasse led to frustration and even outright anger on the part of residents.

During this period, the University of Vermont's Rubenstein School of Natural Resources (UVM-SNR) began looking for a candidate neighborhood for a research and community involvement project called "Redesigning the American Neighborhood," aimed at exploring how community decision-making affected the choice and scale of stormwater management interventions. Working with City officials, UVM-SNR faculty and staff began discussions with Butler Farms residents and eventually began outreach within the larger neighborhood. At its outset in 2003, the RAN project intended to provide information, but also to work on defining the communication and decision-making problems within the neighborhood related to water quality and stormwater.

These three education programs thus came into effect roughly simultaneously, and in a highly charged environment in which many citizens associated "stormwater" with political conflict and problems with home sales. A very diverse set of stormwater education and outreach needs were faced simultaneously by the municipalities subject to the MS4 permit, the City of South Burlington, and the Butler Farms neighborhood (among many others). A comparison of the scale issues among these three settings (Figure 3, below) illustrates the challenges for adapting social marketing to each setting. The responses illustrate a wide spectrum of ways that social marketing techniques can be adapted to deal with different needs, while capitalizing on work done elsewhere.

Figure 3. Scope, Decision-Making and Financial Implications

	Geographic Scope & Target Audience	Decision-Making Body	Key Regulatory Authority	Financial Implications for Target Audience
Chittenden County RSEP	17-municipality County; area served by major Burlington media	Ten-town Steering Committee governed by MOU	U.S. EPA & VT Agency of Natural Resources	None; objective is individual behavior change
South Burlington Stormwater Utility	Single municipality (16.1 square miles, 17,000 residents)	Five-member City Council	VT Enabling Legislation for Utilities; City Council	Average of $54.00 per household per year; average of $800 per business per year
RAN – Butler Farms Neighborhood Stormwater Upgrade	253 single-family households	Informal residents' committee, with City Council and VT ANR	VT Agency of Natural Resources	Potentially $3,000 - $5,000 per household, financed over 10 years by City

III. Social Marketing Techniques: Starting with the Region, and Scaling Down

While the context and objectives for each of the three projects was somewhat different, the Chittenden County Regional Stormwater Education Project ("the RSEP") became the foundation for the use of social marketing in the other two cases. The overall purpose of the RSEP social marketing program is to cost-effectively close the gap between the Chittenden County public's current stormwater-related knowledge, attitudes and behaviors and the desired knowledge and behaviors based on the EPA's best management practices (BMPs). The measurable outcomes in this case, described in more detail below, were to achieve three goals during the five-year program: (1) People living and working in the Chittenden County MS4s will be able to explain the link between stormwater runoff and water quality; (2) People living and working in the Chittenden County MS4 areas will be able to identify resources to help them maintain a stormwater-friendly lifestyle and

spread the word to their friends and colleagues; and (3) People living and working in the Chittenden County MS4 areas will adopt specific behavior and lifestyle changes identified by the results of a 2003 public stormwater awareness survey.

Using social marketing techniques, the RSEP communications and marketing strategy identifies the needs and wants of specific target audiences and identifies messages designed to modify each target audience's behaviors. The RSEP uses a combination of television, radio, print, video, and a program Web site, as well as educational events, to distribute messages linked to understanding stormwater and how individual behaviors affect specific stormwater problems, such as pet waste, home projects, toxic chemicals, car washing, erosion, and fertilizer.

For the RSEP campaign, Social Learning Theory (SLT) informed the assessment of the interaction of personal factors, environmental influences, and stormwater-related behaviors. A basic premise of SLT is that people learn not only through their own experiences, but also by observing the actions of others and the results of those actions. SLT also predicts that individuals can build confidence (self-efficacy) in their ability to take action/change in small steps, if they are given information about the likely results of action, combined with encouragement and clear benefits. A social norms approach was also used to reinforce the perceived benefits of small individual stormwater behavior changes and to overcome the perceived barrier of what could otherwise be seen as the overwhelming challenge of achieving a large, collective behavior change before water quality is improved.

Diffusion of Innovations Theory addresses how new ideas, products, and social practices spread within a society. The RSEP campaign activities were designed to stimulate the diffusion of new social practices and perceived norms about stormwater-related behaviors and products. These theories were selected because research suggests that a

multi-level approach which includes awareness, social norms and an individual sense of self-efficacy best support successful behavior change and maintenance.

To conserve resources, ads were developed for the RSEP by building, with permission, from existing stormwater programs. Through background research on other programs, specific messages and behaviors matching the targeted behavior changes for Chittenden County were identified. For example, a pet waste TV ad developed for the city of Tuscon, Arizona, matched both the message and behavior identified for the RSEP, but the visual landscape of Tuscon is very different from the landscape in Chittenden County, Vermont. A small portion of Tuscon's ad could be used to reduce the costs of creating material tailored to target audiences in Chittenden County.

In addition to the media campaign, the RSEP uses an interactive Web site called "Smart Water Ways" (www.smartwaterways.org) to raise awareness and encourage positive behavior change in Chittenden County residents. The Web site includes a five-minute video and an interactive map that provides receiving water information for each of the jurisdictions participating in the RSEP, as well as an overview of stormwater problems related to targeted behaviors. Through the Web site, users can watch the cable television advertisements or view the storyboards for the ads. They can also obtain fact sheets that contain simple practices to address various stormwater problems. In the fifth year of the RSEP social marketing campaign, the results of a post-campaign survey will be compared to the 2003 baseline survey as one measurement of the program's effectiveness in changing stormwater knowledge, attitudes and behaviors.

South Burlington Stormwater Utility: Roughly two years after RSEP, the City of South Burlington retained the consultant conducting the RSEP to prepare an outreach plan in anticipation of adopting the State's first stormwater utility – and the associated fee of

$4.50 per ERU per month, or about $54.00 per year for the typical household and $800 per year for a typical business or non-profit use. The desired outcome in this case was far more focused, and targeted only to land owners within South Burlington: to build public support for City Council's anticipated adoption of a stormwater utility ordinance and fees, and to prevent a voter backlash that could recall the ordinance and derail the process.

In strong contrast to the Butler Farms and RSEP efforts, the outreach plan focused almost exclusively on costs and benefits to prospective rate payers and minimized behavior change and larger watershed issues. This was a simple issue of triage: to get the utility up and running with sufficient resources, there had to be a sufficiently direct relationship between the utility's costs, and the public operational needs and ratepayer benefits. Ironically, the State's permit problems made it much easier for the City to make the case that having trained staff and resources to help with permit issues was worth the cost.

However, as in the other two cases, target audience definition – identifying similarly affected groups of prospective ratepayers with common issues – was crucial and proved highly successful. The outreach plan used meetings with different target audiences – large ratepayers, institutional uses, condominium associations, medium-sized businesses – as an important way to gather more information on citizens' perceptions and needs around stormwater. As an example, several common legal and permit renewal issues for lot owners in commercial subdivisions were discovered that required State action. The City's utility staff has been able to address this with State regulators, where individual business owners likely would not have been able to do so. This is a good example of how public managers involved in stormwater can use the basic social marketing concept of target audiences to tailor services more directly to community needs.

Butler Farms – Redesigning the American Neighborhood: The third program to get started was the Butler Farms – RAN project. Working with South Burlington staff, the UVM-SNR faculty identified this neighborhood as an ideal laboratory for looking at how stormwater treatment choices affect water quality in a typical American suburban subdivision. Where social marketing is concerned, the desired outcome of this initiative is to evaluate the impact of community decision-making on the choice and scale of stormwater management interventions, and the subsequent impact on water quality.

Entering into Butler Farms in the midst of the State stormwater permit crisis took time, patience, and persistence. Citizens just discovering that the title to their homes was threatened by an expired stormwater permit, and that the new City fee of $54 per year would not remove that threat, did not make an easy or receptive audience for social marketing around behavior change and community decision-making. After some initial, cautious outreach to a group of residents concerned about water quality, a pre-program survey was administered by the University of Vermont and the results compared to the RSEP survey (Figure 4). This information was then filtered by City staff and UVM-SNR faculty to design an information program[6]. Through several presentations by the City and UVM-SNR faculty, and additional mailings, neighborhood residents slowly came to sort out issues of the State permit problems, the City utility, and their own homes. Once the roles and responsibilities of different agencies were sorted out, it became clear that there is a pressing need to work with the City, upgrade the neighborhood's privately-owned stormwater system to State standards, and turn over the system to the newly-formed Stormwater utility – thereby relieving neighbors of individual responsibility for the state

[6] Results on understanding of the overall stormwater system were very consistent, but the Butler Farms neighborhood had unusually high rates of pesticide, herbicide and fertilizer use compared to the region.

Figure 4. Comparison of Regional and Butler Farms Survey Responses

		Chittenden County Regional Survey	Butler Farms Neighborhood
Use pesticides?	***Yes***	***39%***	***82%***
	No	61%	18%
Use lawn fertilizers?	***Yes***	***40%***	***85%***
	No	60%	15%
Always clean up after pets?	Yes	72%	73%
	No	28%	27%
Where does stormwater go?			
	Don't know	***27%***	***32%***
	Streams/Lake Champlain	20%	19%
	Stormwater treatment system	27%	35%
	Wastewater treatment plant	3%	10%
	Absorbed into ground	19%	2%
	Other	4%	2%

discharge permit. Roughly 25 citizens have formed a volunteer study group, under the auspices of the City, which is now exploring the ecological, financial, and aesthetic implications of different approaches to fixing the neighborhood's system.

The UVM team is now applying an innovative approach called Participatory Modeling, when discussion groups are formed around a systems model that is built with the citizens' participation, as an on-going process of collecting information, testing this information against the knowledge available from the residents, and translating assumptions and data sets into the formal language of dynamic models[7][8]. This serves as a common ground for discussions and helps discipline the process of deliberation and decision-making. Citizen participation is especially important to design scenarios for change and to test the feasibility of the proposed management practices.

[7] Gaddis, E., Vladich, H., Voinov, A. 2005. Participatory modeling and the dilemma of diffuse nitrogen management in a residential watershed. Enviironmental Modeling and Software (in press).
[8] Van Den Belt, M., 2004. Mediated modeling: A systems dynamic approach to environmental consensus building, Island Press, Washington.

IV. Lessons Learned

The over-arching theme from the experience in Chittenden County and South Burlington can be summed up as educational triage in a social marketing context: choosing the key desired outcome at a given program's scale; defining and understanding the target audience's greatest barrier; and accepting that not all of the outcomes, particularly behavior change, can be accomplished if the priority outcome has significant implications for the audience. Put more bluntly, when asking a target audience for money for stormwater projects, asking for behavior change may be asking too much and may undermine your key objective – unless the behavior change has a sufficient financial incentive attached.

The scale of the financial implications is especially important in designing a message and using social marketing. In general, the larger the potential financial burden, the less likely households are to internalize simple behavior changes at the same time. Intensive, detailed, and carefully presented information is needed for the projects with significant financial implications, and can help move residents towards a solution. However, over-loading the message with behavior change information can backfire and undermine the overall goal – "I may have to pay $3,000, and now you want me to stop washing my car at home?" Policy-makers must, faced with this situation, choose the more important outcome and save the less pressing need for later. The exception, of course, is a sufficient financial incentive makes the perceived cost of the behavior change worthwhile.

With respect to whole-systems thinking, all three programs indicate that scale and the presence of financial issues play a major role in when and how to use social marketing to introduce whole-systems thinking. The surveys from both the RSEP and RAN show that in the absence of a strong education program, there is little systems thinking about regional or neighborhood stormwater issues. Persistent themes of concern for the environment,

paired with a disinclination to change individual behaviors, were present in both. The neighborhood and regional surveys also are consistent with national findings that higher levels of education do not necessarily translate into sound environmental decisions or a willingness to accept whole-systems thinking. Citizens with advanced degrees often display behavior patterns totally divorced from what best management practices recommend.

It is not yet clear to what extent the financial implications serve the purpose of whole-systems thinking. The RAN team's early discussions with neighborhood residents about the systems approach to stormwater management garnered only lukewarm interest and participation. But growing neighborhood awareness of the financial implications of the *Lowe's* case and City utility for home sales and costs invigorated the process dramatically, and attendance at meetings jumped by an order of magnitude.

The challenge in Butler Farms now is to frame conversations about who pays, how much and when in a whole-systems context. It appears that this combination of a large potential financial impact, an intensive, detailed and neighborhood-specific education program, and community decision-making, may offer the opportunity to incorporate systems thinking into the choice of stormwater solutions. However, there is a constant danger of "too much information," and placing too many behavior change demands on individuals faced with a large cost. The final outcome of this project hopefully will shed some light on how these objectives can be balanced.

A municipally-scaled program with some financial impact is perhaps the trickiest of the three scales and settings for social marketing and promoting whole-systems thinking. A municipal program at this scale gives citizens the opportunity of communicating most directly with elected officials, but also the threat of local ordinances, property taxes, and fees. Social marketing campaigns must strike a careful balance between what a

municipality can compel its citizens and land owners to do, through ordinance or fees, and promoting what the governing body would like its citizens to do in the way of stormwater-friendly behaviors. The fine line is between encouraging citizens to pick up after pets with signs and poop-bag stations, and adopting an enforceable leash law or clean-up ordinance.

In addition, the variability of public discussion and opinions at the municipal scale makes it especially difficult to stick to a long-term outreach and education plan with pre- and post-implementation monitoring. A neighborhood-scaled project can and should reflect the unique needs of a discrete group of residents with a defined physical and social geography, and a multi-year regional project is less affected by the month-to-month fluctuations of public opinion, letters to the editor, and statements at public meetings. In a typical Phase II MS4 community, however, the tenor of a single City Council meeting can swing the debate, or create a distracting issue requiring a quick and flexible response.

The best scale of outreach in the South Burlington experience came at the target audience level, where City administrators were able to identify common stormwater issues that were best addressed by the public sector. The Utility's ability to respond to needs defined by the target audiences (e.g. providing an authoritative "FAQ" document about State permits for homeowners' associations and developing a model process for commercial subdivisions with single discharge permits) has built strong support and goodwill towards the City's utility. Above and below this level, however, municipal outreach had to stick to the basics of costs and benefits of services to be effective.

The hope for greater whole-systems thinking at the municipal, neighborhood, and regional levels is in greater citizen engagement in decision-making and reinforcement of social norms for acceptable individual behaviors. Citizen engagement is a costly and intensive process that may be hard to afford and accomplish on a statewide or even a larger

municipal scale. The RAN-Butler Farms case study, which is showing great promise in this area, is still somewhat special, enjoying financial support from the U.S. EPA and the City. Balancing the high costs and time needed for full scale citizen education and involvement programs, with the need for significant and urgent capital programs and permit compliance, is a challenge yet to be conquered.