# Status Report #1

**Redesigning the American Neighborhood:**
**Cost Effectiveness of Interventions in Stormwater Management at Different Scales**

**[Grant No. X98187601-0]**


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## Introduction

This report provides a summary of work completed during the first six months of the *Redesigning the American Neighborhood* (RAN) project (U.S. Environmental Protection Agency (EPA) Grant Number 525809). The goal of this project is to quantify the balances among environmental, economic, and social costs and benefits for alternative stormwater management techniques at whole-watershed, neighborhood, and individual house scales in a typical New England landscape and climate. A full description of the RAN project, and the specific objectives and timelines discussed below, were provided in the project work plan dated October 28, 2003. Briefly, the project objectives are:

*Objective #1 - Assessment:* Develop a framework to assess opportunities for intervention in adaptive stormwater management at various spatial scales and apply this framework to the Potash Brook case study.

*Objective #2 - Evaluation:* Complete a comparative cost/benefit analysis of the alternatives identified for the case study in Objective #1, which accounts for environmental and social/community factors as well as purely economic factors. Identify potential market-based incentives that could facilitate implementation of the identified alternatives.

*Objective #3 - Participation:* Involve community stakeholders in the development and evaluation of Objectives #1 and #2 through 'town or neighborhood meetings' that rely on whole-watershed visualization tools and multi-criteria decision aids to promote shared learning among the project participants.

*Objective #4 - Implementation:* Initiate a demonstration project that can be used as a focal point to test ideas and designs generated by Objectives #1-3.

To date, progress has been made on all four project objectives, as summarized in the following section.

## Progress on Project Objectives

*General progress:* The final work plan for the RAN project was accepted by US/EPA in fall 2003 and the team members immediately began work on all four objectives (Table 1). This project is a collaborative effort with the City of South Burlington and the Winooski Natural Resources Conservation District and so it was necessary to coordinate our activities closely with these partners. We have established three levels of working groups for this project (Table 2). The first group is the core research team which has primary responsibility for this grant. The second group includes key collaborators who have independent EPA projects that will be coordinated with this project. Finally, we have established an advisory group, which includes the core and partner members, plus additional members who have direct interests in this project. A full list of the group membership and associations is provided in Table 2. Several meetings were held in the fall by various of these groups, to establish roles and responsibilities. The core group continues to meet at least twice each month for project management. The partner group meets at least every other month to manage inter-project interests. The advisory group meets quarterly to semi-annually to review progress and obtain feedback.

*Progress on Objective #1 - Assessment: Develop a framework to assess opportunities for intervention in adaptive stormwater management at various spatial scales and apply this framework to the Potash Brook case study.*

The core group has discussed at length the nature and extent of the stormwater management support "toolbox" that was visualized as the primary output from this objective. Review of the literature and of existing web resources shows that there are numerous sources of information already available that describe various options available for both traditional and low-impact stormwater management designs and practices. While useful, this information is likely to be overwhelming to lay endusers who are seeking solutions to particular problems. Even developers or municipal planners are likely to find it difficult to identify which practices are best suited to the specific needs they are trying to address.

It would be impractical (and unhelpful, actually) for us to simply repackage or summarize these best management practices (BMP). This has been done, both nationally (e.g., the National Stormwater BMP Database, http://www.epa.gov/OST/stormwater/#nsbd) and by Vermont (e.g., the 2002 Vermont Stormwater Manuals, volumes I and II, http://www.vtwaterquality.org/stormwater/htm/sw_publications.htm). Furthermore, every local situation is different. Developments are of different ages, have different layouts, and interact with their environment in different ways. It is impossible to anticipate every situation in which a community member or stormwater manager might be interested. Furthermore, the endusers themselves have different interests and objectives. It is equally impossible to anticipate these varied outlooks. What is needed is a decision support tool that can guide these endusers through a process that includes self-examination, dialogue, and knowledge assessment leading to a narrower set of choices from among a wide number of options.

We plan to develop this decision support toolbox ("toolbox", for short) in a hypertext format that would be suitable as either a web-based site or a stand-alone CD. The web-based option will allow greater connectivity to related resources. The CD will allow wider dissemination of the product. Our experience has been that many endusers either don't use or don't feel entirely comfortable with products that are exclusively available on-line.

We have begun to gather materials (data, photos, documents, and links to other sites) that will be used for the toolbox. In addition, we are beginning to develop our ideas for how the framework will actually function. We foresee that a community member or town planner will be able to employ the toolbox to identify BMPs that are relevant for the community, given a set of criteria identified by the user (such as budget, land base, zoning and density issues). The user will quickly be able to evaluate different BMP options from both environmental and economic viewpoints. Once a set of options has been identified, the toolbox will lead the user to resources that elaborate on these options. Some of these resources will be a part of the toolbox itself; others will be on-line. This latter functionality will serve a dual purpose as an educational tool. For example, prior to selecting any options, users may simply need information about particular options. The user will be able to respond by choosing a "tell me more about…" option, which will route them to pages that offer explanations and uses of the specific BMP. As mentioned above, much of this information already exists in on-line resources. Our efforts will focus on the user interface and navigation through these existing resources in such a way that is comfortable for a community member who may not be familiar with the language or concepts regarding stormwater management.

As described in our work plan, we are using the Butler Farm and Oak Creek neighborhoods in South Burlington, Vermont as a 'test bed' for our project. Thus we have begun to gather specific data about this

locale, which will be useful for both descriptive and research purposes. These resources include, for example, historical GIS base soil data, and maps of watershed boundaries, streams, elevations, roads, and hydrology. In addition, we have begun to investigate specific low-impact designs and other eco-technologies that maybe suitable for use in this neighborhood. Our intention is to offer these options as concrete alternatives for the community (and the town managers) to consider for implementation is year 2 of this project.

Finally, we have developed a RAN project website (http://www.uvm.edu/envnr/potash/Homepage.htm) which serves several functions. First, it describes the project mission and objectives. Second, it serves as an archive for data, reports and media developed for this project including, for example, our community survey. Third, our website provides links to other sites with general information about watershed management and stormwater management practices. Finally, the website profiles the project collaborators, with contacts for each person.

*Objective #2 - Evaluation: Complete a comparative cost/benefit analysis of the alternatives identified for the case study in Objective #1, which accounts for environmental and social/community factors as well as purely economic factors.*

This objective is directly dependent on Objective #1. To date our efforts in Objective #2 have been confined to gathering data that will be relevant to the toolbox. The analysis will eventually take shape of a 'ranking tool' – an Excel spreadsheet that will contain information about the main alternatives available and a set of priorities that the user can identify (installation, cost, operation and management, stormwater quantity, peakflow, baseflow, stormwater quality, etc.). Once the priorities are chosen, the alternative technologies will be ranked according to them. (See http://www.uvm.edu/giee/AV/OSDS/RankSeptic.xls for a prototype).

*Objective #3 - Participation: Involve community stakeholders in the development and evaluation of Objectives #1 and #2 through 'town or neighborhood meetings' that rely on whole-watershed visualization tools and multi-criteria decision aids to promote shared learning among the project participants.*

We have established a good connection with a group of concerned neighbors in the Butler Farm/Oak Creek (BF/OC) neighborhoods. While there is no formal Homeowners' Association (HOA) in either neighborhood, this informal connection should adequately meet the needs of the project. Our efforts to establish neighborhood connections within the framework of the RAN project have been viewed favorably, since this may lead in the future to some more structured networks and possibly a HOA.

We have had three meetings with the neighborhood group. The first meeting was to describe our project and get initial input about the problems and concerns of the residents. We met a second time to discuss the draft of the survey that was developed. The group was very helpful in framing some of the questions in a way that the residents could better understand and give clearer responses. The neighborhood group volunteered to help us distribute the survey in the neighborhood. It was agreed that if the survey was regarded as a neighbor-to-neighbor activity, we could expect higher return rates.

The survey was developed with three goals in mind:

1) to understand how people perceive the stormwater issues and determine what they know about storm water related problems;

2) to collect information about the behavior patterns and daily practices related to stormwater in the neighborhood; and,

3) to evaluate the overall level of environmental awareness and willingness to act and/or change in the neighborhood.

We received 99 completed surveys (out of 200, nearly a 50% return) and all surveys have been processed. The survey will also serve certain educational purposes, as it makes people think about issues that they may not have been considering before. Results from the survey have been posted on the RAN project website.

The third meeting on April 14th consisted of a major project presentation to the stakeholders at the South Burlington City Hall. Preliminary results of the survey were reported and discussed. This meeting was our first extensive outreach to the whole community and provided the basis for a wider working group which will be our liaison for future work on the project.

*Objective #4 - Implementation: Initiate a demonstration project that can be used as a focal point to test ideas and designs generated by Objectives #1-3.*

In the fall of 2003, area reconnaissance work was performed to identify potential sampling locations and assess subwatershed conditions. Tributary 7 was surveyed during several heavy rain events, and well as under normal base flow conditions, and sampling locations were selected above and below the Butler Farms and Oak Creek Neighborhoods. Property access and installation permission were coordinated through the City of South Burlington. Different options for stream monitoring were investigated and discussed, and preliminary calculations for weir installations were completed. Selection of the specific equipment to use for this aspect of the project was completed and orders were placed. Unfortunately, the final sign-off on the workplan was not completed until October 2003 and because of the lengthy lag time required to negotiate, order, test, and install equipment, we were unable to implement this objective during the fall 2003 period as was hoped. Furthermore, because it is difficult to install new field equipment in the spring high flow period, we were unable to acquire spring samples in 2004.

However, the delayed weir installation proved to be beneficial as it provided additional time to consider monitoring strategies and experimental design. Detailed field reconnaissance in the fall revealed that persistent low base flows in Tributary 7 posed serious technical problems for the proposed functional assessments and brought into question what these assessments would really reveal. Furthermore, we found that a tributary between the proposed second and third sampling stations was more important than initially thought and compromised the utility of the lower sampling site (well below the neighborhood within city-owned conservation land). Consequently, we decided (after consultation with the EPA Project Managers, Beth Alafat and Eric Perkins) to eliminate this lower station and instead expand significantly the functional assessment portion of this objective.

The functional assessment component of Objective #4 was expanded to include a set of six ‘paired’ watersheds: three stormwater impaired watersheds and three reference (or ‘attainment’) watersheds. Lower Potash Brook was retained as one of the impaired watersheds and a survey was mounted to identify a set of 5 other matching stream reaches. This survey involved both extensive field reconnaissance and consultation with other knowledgeable faculty at the University of Vermont (UVM) and staff at the Vermont Agency of Natural Resources (ANR). Including more functional assessments

will capitalize on an opportunity to contribute to the specific needs identified by the Vermont Water Resources Board (WRB) during the recently completed stormwater docket, concerning the use of stormwater 'impaired' and 'attainment' reaches. For example, while the original work plan described several *days* worth of whole-stream metabolism experiments in only 2 locations, the newly expanded plan will entail nearly *continuous* monitoring on 6 sites (3 paired 'impaired' and 'attainment' reaches) from late-May to November. A full description of the expanded functional assessment work will be forthcoming in the year 2 work plan. The same methodology will be employed; the primary differences from the original workplan are the locations (larger tributaries) and numbers (from 2 to 6) of installations. We believe that this expanded assessment will provide valuable information concerning the nature of the ecological impairment resulting from stormwater impacts, as well as potential new methods for assessing stream recovery.

Full installation of equipment has now been accomplished and we have acquired a number of sample sets which we are currently evaluating. The monitoring equipment will remain in place until freeze-up in late November.

Next Steps

During the upcoming months, we will continue to develop the toolbox framework and will accelerate our efforts to include the evaluation components of objective #2.

We will continue to develop our relationship with the BF/OC communities and plan to hold an informal, informational field day on site, in September 2004.

We will continue to monitor flow and collected samples for intensive analyses at the two Tribuatary 7 sites and will continue the whole-stream metabolism functional assessments until late fall 2004. We plan to do at least one and ideally two sets of 6 stream solute additions before freeze up.

By late July we will submit to EPA an amended work plan covering the second year of the project. As agreed with the current EPA Project Manager (Eric Perkins), this submission will be in the form of an amendment, rather than a new work plan, as the new work is an evolutionary extension of the existing work.

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Alan McIntosh, UVM Project Manager Date

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William (Breck) Bowden, UVM Project Manager Date

Table 1. Summarized list of deliverables for the University of Vermont RAN project with status noted.

**Month 1**
- Coordinate team effort DONE
- Assign individual duties DONE
- Establish key boundaries and locations for field work DONE

**Months 2-4**
- Survey Tributary 7 of Potash Brook for pollution "hot spots" (Previous work by Pioneer and others will help inform the survey). DONE, WE ARE EXTENDING THIS WORK TO ALL POTASH
- Establish key sampling points in Butler Farm focus area DONE
- Identify a stakeholder workgroup, hold the first workshop BOTH DONE
- Collect background 'desktop' data DONE BUT CONTINUING
- Conduct geomorphological assessments IN PROGRESS
- Establish a project web site DONE

**Months 2-6**
- Survey and map points of opportunity IN PROGRESS
- Evaluate suitable eco-technologies for a pilot IN PROGRESS
- Build a scoping model of the neighborhood and discuss it with the stakeholder group
- Conduct a survey on values and priorities in the neighborhood IN PROGRESS
- Update website CONTINUING

**Months 6-9**
- Develop and refine the first draft of the interventions decision support tool IN PROGRESS
- Refine the modeling tools. Start working on the full watershed model
- Submit a status report to US EPA DONE WITH THIS REPORT
- Update website CONTINUING

**Months 8-9 Are we on track for this in mid-summer?**
- Second workshop. Discuss modeling and design visualization tools that could benefit the neighborhood. PLANNING FOR SEPTEMBER
- Update website CONTINUING

**Months 9-12**
- Present the model to stakeholders in a public workshop PLANNING UNDERWAY
- Conduct the bioassessments and monitor water quality IN PROGRESS

**Months 11-12**
- Further refine decision support tool
- Chronicle results
- Summarize the bioassessment and water quality data
- Integrate report with team members
- Conduct second survey to evaluate the project impact
- Update website and produce other media (brochure, CD/DVD) for public dissemination
- Establish future work plan contingent on available funding

Table 2. List of key stakeholders in the RAN project. 'Core' members are the persons responsible for this research project. 'Partners' are key affiliates with this project. 'Advisors' are important stakeholders with direct interests in this project.

| **Name** | **Affiliation** | **Association** |
|---|---|---|
| Allan McIntosh | University of Vermont | Core (UVM project manager) |
| Breck Bowden | University of Vermont | Core (UVM project manager) |
| John Todd | University of Vermont | Core |
| Bob Costanza | University of Vermont | Core |
| Alexey Voinov | University of Vermont | Core |
| Alex Hackman | University of Vermont | Core |
| Tim White | University of Vermont | Core |
| Helena Vladich | University of Vermont | Core |
| Eric Perkins | EPA Region 1 | EPA Project Manager |
| Peg Brakeley | BF/OC resident | Partner |
| Al Frank | BF/OC resident | Partner |
| Ben Gabos | Winooski Nat Res Consv Dist | Partner |
| Juri Homziak | UVM Sea Grant | Partner |
| Juli Beth Hoover | Town of South Burlington | Partner |
| Carol & Greg Lothrop | BF/OC resident | Partner |
| Jeff Nelson | Pioneer Environmental | Partner |
| Abby Willard | Winooski Nat Res Consv Dist | Partner |
| Karen Bates | DEC Watershed Coordinator | Advisor |
| Doug Burnham | VT ANR | Advisor |
| Bob Kort | US NRCS | Advisor |
| Rick Levey | VT ANR | Advisor |
| Jim Pease | VT ANR | Advisor |