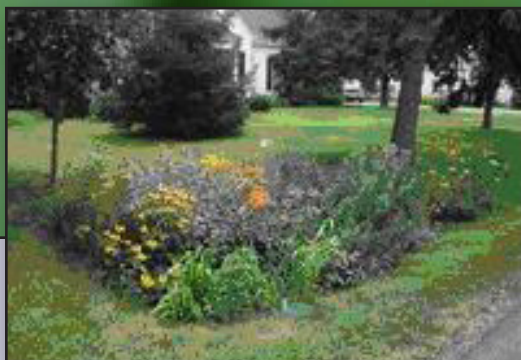
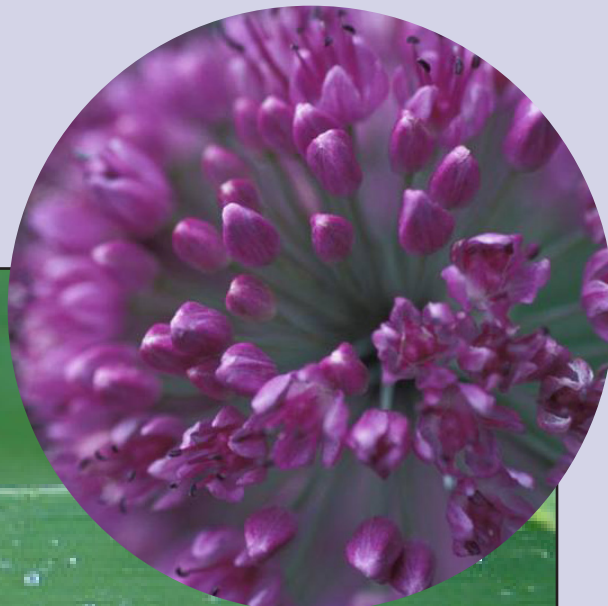

Rain Gardens for Lake Ripley Watershed

How a community-based social marketing program can promote rain gardens

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TABLE OF CONTENTS

<u>OVERVIEW OF COMMUNITY-BASED SOCIAL MARKETING (CBSM)</u>	6
State, National and International Rain Garden Programs.....	11
Wisconsin Rain Garden Projects.....	12
Rain Garden Programs outside of Wisconsin	13
<u>THE SETTING</u>	14
The Lake Ripley Watershed.....	14
The Lake and Changes Over Time	15
The Lake Ripley Management District	17
The People in the Watershed	17
<u>THE ENVIRONMENTAL PROBLEM</u>	19
<u>TARGET BEHAVIOR IDENTIFICATION</u>	19
Selecting the Target Behavior.....	20
Where the Target Behavior would be Applied	21
Direct Impact of the Target Behavior on the Environment and Potential Magnitude of Impact	21
Frequency of Practicing the Targeted Behavior	21
Presence of External Barriers	22
Opportunity for Application of CBSM Tools.....	24
Potential for Incentives	24
Feasibility of Monitoring the Effects of the Target Behavior.....	24
<u>MOTIVATION, OPPORTUNITY AND ABILITY ANALYSIS</u>	25
<u>CHAIN OF CAUSALITY ANALYSIS</u>	27
External Incentives and Constraints	27
Values and World Views	28
Attitudes and Beliefs	29
Knowledge	29
Attention and Commitment	30
<u>CURRENT COMPETING BEHAVIORS</u>	31

TARGET AUDIENCE & CONTEXT	34
Individual Parcel Targeting	34
Target Areas of Social or Geographical Influence	34
Identify willing or Influential Landowners as Targets	35
BARRIERS AND BENEFITS ANALYSIS	36
TOOLS FOR CHANGE	40
Step 1: Identifying Target Properties	40
Step 2: Designing Effective Tools	40
Step 3: Information Dissemination and Communication	42
Other Communication	46
Step 4: Commitments	46
Recommended Commitments	47
Step 5: Incentives	47
Recommended Incentives	47
Step 6: Norms	48
Using and Establishing Community Norms	49
Step 7: Prompts	51
Recommended Prompts	51
MONITORING AND EVALUATING THE SUCCESS OF THE PILOT STUDY	51
APPENDIX A: TARGET BEHAVIOR RESEARCH	56
APPENDIX B: COVER LETTER AND QUESTIONNAIRE INSTRUMENT	73
Cover Letter	73
Lake Ripley Management District Rain Garden Questionnaire	74
APPENDIX C: TYPES OF RAIN GARDENS	77
APPENDIX D: COMMITMENT FORM	79
APPENDIX E: SIGN AND STICKER IDEAS	80

FOREWORD

This report is the product of three months of work undertaken by a team of graduate students in the Spring 2007 UW-Madison course entitled Human Behavior and Environmental Problems. The focus of the course is on what contribution social psychology and related disciplines can make toward understanding and helping to solve environmental problems. The course is intended to provide both a theoretical framework and an empirical basis for those university students who will one day be doing environmental planning, environmental education or natural resources management.

Part of the course was conducted as a workshop in which the principles of community-based social marketing (CBSM) were applied to water quality issues within the Lake Ripley Management District located in southeastern Wisconsin. In recent years, CBSM has attracted a lot of interest in Wisconsin among UW-Extension personnel, Wisconsin Department of Natural Resources staff, and representatives of environmental organizations. Many have taken one or more workshops conducted by Douglas McKenzie Mohr, author of *Fostering Sustainable Behavior*. These are individuals who have had the courage to question the status quo of their institutions or organizations and are open to new ideas and approaches to environmental protection.

As with any approach that challenges business-as-usual, many questions have arisen about how to plan and implement a CBSM program. This report documents the process of planning a CBSM program much more thoroughly, and in much more detail, than is usually found in most reports of CBSM projects. The purpose is to give the reader a chance to “look over the shoulder” of a team that has gone through the CBSM planning process from beginning to end.

A major part of CBSM planning is the analysis of perceived barriers and benefits and this is shown in detail in the report. But some material goes well beyond the skeletal process described in *Fostering Sustainable Behavior*. How CBSM differs from other approaches, especially the more traditional educational and informational approaches, is described in this report. Which behavior to select as the target of a CBSM program is another question often raised by those who are trying to understand the process; this report shows the results of an analysis in which several potential target behaviors were evaluated by several different criteria before selecting the target behavior. The students also conducted a Motivation, Opportunity, Ability analysis based on work done by Michael Rothschild. The analysis answers three important questions: (1) is a potential target behavior a good candidate for a CBSM approach?, (2) could the behavior be promoted more easily using educational or informational approaches?, or (3) is the potential target behavior likely to occur only if a regulatory program is enacted? Yet another analysis not usually performed either in CBSM projects or more traditional informational campaigns, is a Hierarchical Causal Change Analysis. The idea is that if behavior change is going to occur, there must be a set of conditions that are satisfied other than the target audience simply knowing what to do or how to do some pro-environment behavior. The reader should find this analysis to be a very useful tool when launching some new environmental education initiative.

All aspects of planning a CBSM project are described in this report, but some are necessarily incomplete. The class had to accomplish a lot within the standard, yet artificial, university semester time-frame. Thus, while a focus group was conducted, there were fewer participants than one would like to have. Nonetheless, this report describes the process in detail. Similarly, the team prepared a questionnaire as part of the formative research process used in the CBSM process, but there was insufficient time to mail the surveys, get a reasonable return rate, segment the audience and incorporate the results into the recommendations for tools that would directly address the perceived barriers and benefits of the target behavior. Here again, although the surveys could not be distributed, the survey instrument is included in the report and could be implemented whenever time and resources allow. Finally, there are a few changes to this report that the team would have liked to make before going to press, but time and circumstances precluded these last minute revisions; the end of the semester waits for no one.

The reader will no doubt appreciate both the quantity and quality of the effort that the team has put into this project and this report. Those with an interest in CBSM will benefit substantially from this report. The more that students and professionals in Wisconsin gain hands-on experience with the process of planning a CBSM project, the more likely it is that CBSM will be added to the arsenal of approaches to environmental protection in Wisconsin.

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Overview of Community-Based Social Marketing (CBSM)

Land managers, scientists, and agency staff often have very similar responses when dealing with environmental problems that are caused, or affected in a major way, by the public:

If people only knew about the problem, and how they affect it, then they would certainly act in a positive way to end the issue once and for all.

-John Doe, Environmentalist

Spurred on by this thought, conservation groups, university extension service, and natural resource agencies produce a myriad of pamphlets and other information sources for the public to get the information that they presume will change how people behave. Unfortunately, this is often where the work of these organizations and government agencies ends; the information has been provided, the responsibility for change is now in the public's hands. Several studies have shown that information alone is not sufficient to change people's behaviors. For example, a study conducted in the Netherlands revealed that providing households with information about energy conservation did not reduce energy use.¹ Additionally, high school students who received a six-day workshop that focused on creating awareness of environmental issues were found, in a two-month follow-up, to be no more likely to have engaged in pro-environmental actions than students who did not attend the workshop.²

The general conclusion of these studies, and others, is that changes in attitudes and opinions do not necessarily correspond to changes in people's behavior. While these studies show that behavior did not change in a direct relationship with information available or educational campaigns, it is important to recognize that many more information and educational campaigns go unmonitored. As a result, it is simply not possible to know whether or not the vast majority of these programs are effective either in influencing attitudes and opinions let alone in changing behavior.³

Recognizing that behavior, not attitudes or opinions, is what directly impacts the environment, Douglas McKenzie-Mohr extended principles from the health care industry, where social marketing was being used to promote more healthy personal behaviors, to the promotion of pro-environmental behaviors. His book, *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing*, together with his

¹Midden, C. J., Meter, J. E., Weenig, M. H., & Zieverink, H. J. (1983). "Using feedback, reinforcement and information to reduce energy consumption in households: A field-experiment," *Journal of Economic Psychology* 3:65-86.

²Jordan, J. R., Hungerford, H. R., & Tomera, A. N. (1986). "Effects of two residential environmental workshops on high school students," *Journal of Environmental Education* 18: 15-22.



traveling workshops, have been instrumental in generating substantial interest in community-based social marketing among environmental educators and natural resources professionals.⁴

McKenzie-Mohr focused on the ultimate goal of all information/education campaigns: to change people's behavior. The idea is to substitute a new, pro-environment behavior for an existing behavior that has negative impacts on the environment. Thus, the emphasis in all CBSM programs is on changing people's actions. Changing attitudes and beliefs is important only insofar as doing so can be expected to help facilitate behavior change. The basic program structure is made up of five steps:

1. Selecting a pro-environmental behavior to substitute for current behaviors
2. Identifying barriers and benefits
3. Utilizing behavior change tools
4. Testing strategies initially through a small pilot program
5. Evaluating the success of the pilot program

The initial step in any CBSM program is to identify a behavior that negatively impacts a resource or community. In our program the goal was to improve the water quality in the Lake Ripley watershed which is located in southeast Wisconsin (Figure 1). There are several approaches to improving water quality in a watershed. We selected "reducing storm water runoff" to be the component of water quality on which we would focus. Part of the impetus for selecting reducing storm water runoff as our focus was that we were working in conjunction with another group developing a CBSM program to reduce the nutrient load of stormwater runoff by getting homeowners to use non-phosphorous fertilizer and thus we chose to focus on a different aspect of water quality. After this decision, we identified a number of behaviors that would impact storm water runoff (e.g. redirecting downspouts, using rain barrels, and installing rain gardens). Once a list of pro-environmental behaviors

³Other sample studies include, but are not limited to, the following:

Archer, D., Pettigrew, T., Costanzo, M., Iritani, B., Walker, I. & White, L. (1987). "Energy conservation and public policy: The mediation of individual behavior," *Energy Efficiency: Perspectives on Individual Behavior*: 69-92.

Costanzo, M., Archer, D., Aronson, E., & Pettigrew, T. (1986). "Energy conservation behavior: The difficult path from information to action," *American Psychologist* 41: 521-528.

De Young, R. (1989). "Exploring the difference between recyclers and non-recyclers: The role of information," *Journal of Environmental Systems* 18: 341-351.

Finger, M. (1994). "From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior," *Journal of Social Issues* 50: 141-160.

Hirst, E. (1984). "Household energy conservation: A review of the federal residential conservation service," *Public Administration Review* 44: 421-430.

Hirst, E., Berry, L., & Soderstrom, J. (1981). "Review of utility home energy audit programs," *Energy* 6: 621-630.

Hirst, E. (1984). "Household energy conservation: A review of the federal residential conservation service," *Public Administration Review* 44: 421-430.

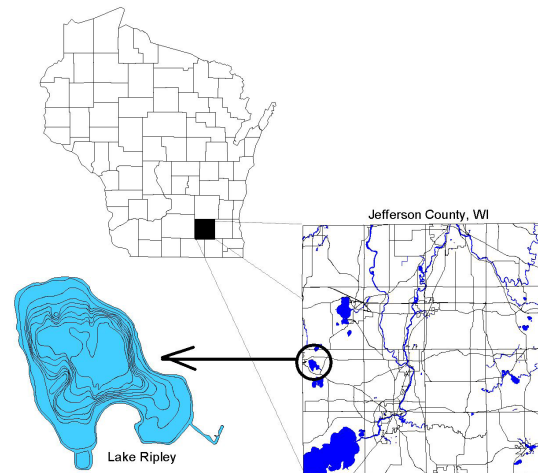
⁴McKenzie-Mohr, D. & Smith. (1999). *Fostering Sustainable Behavior*. Gabriola, Canada: New Society Publishers.



has been identified, the CBSM program planner selects one based on several criteria. The most important criterion is that a change in behavior that is adopted by a plausible number of individuals in a target audience can be expected to bring about a significant improvement in the resource. Based on our review of the literature and discussions with resource professionals, we decided that having people install rain gardens could have the greatest long-term positive effect on the water quality in Lake Ripley.

Figure 1. Location of Lake Ripley in Wisconsin.

Source: Lake Ripley Management District



Rain gardens are planted depressions that occur naturally or are created, and are designed to receive all or part of the excess rain water or melted snow from a developed area. Through a combination of plant type and garden design, rain gardens have the capacity to promote absorption of water into the soil within a concentrated area, which prevents the water from ponding in low-lying areas or eroding the land surface on its way to storm drains or surface water bodies. Rain gardens are one method to provide a means of trapping and filtering pollutants from excess water runoff from a property instead of allowing the water to flow directly into storm sewers, other surface bodies of water, or low areas (Figure 2).

Once a behavior has been identified, the process of identifying the barriers and benefits for a particular action can begin. A barrier is, quite simply, any factor (economic, social, cultural, etc.) that prevents or discourages a person from performing an activity. This means that both the desired behavior and the currently practiced undesired behavior have barriers; the same is true of benefits, which are described below. An example of a barrier might be a homeowner in a snowy climate who places a compost bin far from her home, making year-round access, and correspondingly year-round use, more difficult. At the same time there are benefits (economic, social, cultural, etc.) that encourage people to complete certain actions. Deposit values on recyclables and tax breaks for donating money to a not-for-profit organization are two very common benefits. Since people are going to act



Figure 2. One example of what a rain garden might look like. Other examples can be found in the Target Behavior Identification section.
Source: Lake Ripley Management District.



in ways that benefit them the most they will engage in whatever behavior has the highest perceived benefit to barrier ratio. The paramount goal of a CBSM program is to create the situation where the benefits for a desired activity (e.g. installing a rain garden) and the barriers to an undesired activity are maximized, in essence making the logical choice for anyone to opt for the desired activity.

The salient perceived barriers and benefits may be quite different from location to location or among different populations. Moreover, the perceived barriers and benefits are likely to be very different for different behaviors (e.g. changing homeowners' fertilizer to a non-phosphorous mix has a very different set of perceived barriers compared to getting homeowners to install rain gardens in their lawns). The fact that CBSM programs identify specific benefits and barriers to target behaviors allows CBSM programs to be more effective than a general education program in many cases. This is because traditional educational/information programs assume that the primary reason that a behavior is not being undertaken is a lack of information about an issue. A lack of knowledge may have nothing to do with why a community continues an environmentally destructive activity. In some cases, although many people in a community may know what is the "green" behavior and believe it is the "right" thing to do, they may not be able to do the behavior due to financial constraints or other barriers beyond their control. CBSM programs directly address an individual community's perceived benefits and barriers to create situations where the promoted action is the best choice for individuals to make.

Once a community's perceived barriers and benefits are discovered through focus groups and surveys, many different behavior-change tools are available to CBSM program facilitators. These tools include commitment, prompts, social norms, and incentives. At the simplest level, behavior-change tools increase perceived barriers to activities that are no longer desired (e.g. having a front lawn entirely of turf grass) while increasing the perceived benefits from desired activities (e.g. installing a rain garden in a portion of one's front lawn).



Once the appropriate tools have been selected, strategies to implement the tools are formulated into the CBSM program. The CBSM program is then tested on a small pilot study portion of the target population. After the pilot study is completed, the selected strategy and behavior-change tools are evaluated again and adjusted as necessary based on the sample group's response to the pilot study program. The final component of the program is a monitoring component in which the change in the ultimate target of the program is monitored. Direct measurement of improvement to the resource may not be possible, especially if the change is expected to occur over relatively long time periods or is occurring in a complex system. In this situation, measuring the number of people in the target population who have made the change to the more pro-environmental behavior is a reasonable substitute for direct measurement of changes to the environment.

Advantages to the CBSM process compared to the traditional educational/informational approach are two-fold. First, an educational program is almost inherently generic in its formulation, whereas CBSM methodology is custom designed for individual communities. A major advantage of pamphlets and other informational materials, the hallmarks of purely educational programs, is that they are relatively inexpensive to produce, especially in large volumes. However, the information that is presented is rarely tailored for specific groups; rather the hope is that it will appeal to a large, undifferentiated audience. This reduces the effectiveness of the material. Second, programs based on changing actions through education alone often are not accompanied by any plan to evaluate the program's effectiveness. By contrast, CBSM has an evaluation component explicitly built into the program. Consider the example of a state agency producing a pamphlet on invasive species. Thousands of the informational pamphlets are produced and dispersed across the state to every one of the agency's offices and added to the racks already crowded with pamphlets. Someone is placed in charge of refilling the pamphlet on the rack, but the follow-up with those who take the pamphlet is generally lacking. Evaluating the success of information-only programs is challenging, especially since there often is no way of knowing who picks up the information in the first place. In spite of the lack of evidence of the success of these kinds of programs, the production of pamphlets and fact sheets continues, probably because they are relatively inexpensive and there is a persistent belief that they work.

Although informational and educational campaigns are still the dominant approach to promoting pro-environmental behavior, the use of the CBSM approach has gained an increasing number of advocates in the last decade. From the McKenzie-Mohr and Associates website, one can find a summary of more than one hundred example cases of CBSM used in the realms of composting, energy efficiency, hazardous waste, littering, pollution prevention, recycling, reuse, source reduction, transportation, water efficiency, and



watershed protection.⁵ Specific projects include establishing prompts to reduce littering, beginning community composting programs, and installing energy-efficient appliances in a person's home. This variety of projects includes single-instance actions (e.g. installing weather stripping on a home's windows) as well as repeating actions (e.g. using reusable canvas shopping bags instead of plastic bags).

Promoting rain gardens in a local community is not a novel idea. Quite the contrary, numerous programs have been in effect for years. Nearly all examples of programs advocating rain gardens provide information, tips, cost estimators, and the like, in formats that have mass appeal. With the notable exclusion of the 1,000 Rain Garden Project of Madison and the 10,000 Rain Garden Project of Kansas City, all of these programs are inherently less effective than a CBSM approach, because of the lack of any continual monitoring for the success or failure of the programs. A great deal of time and money must be placed into these programs to make information available and accurate. However, the follow-up with those who access information on rain gardens is limited or non-existent. Beyond hoping that the program will work there are basically no assurances that the time and effort spent on presenting valuable information result in anything more than a well-designed webpage.

Another issue facing educational programs is that there is little engagement of the population thought to be most in need of the information. In other words, pamphlets and information are made available, but only those already interested in acquiring that information are likely to access it. This is likely to be a very narrow audience rather than the broad audience that they are supposedly made available for. CBSM methodologies go beyond presenting information on how to install a rain garden, and work to make everyone in a community interested in rain gardens. CBSM works with those people who would not otherwise even consider installing a rain garden on their property.

Opportunities to utilize CBSM methodologies in Wisconsin are abundant. Hopefully, the existing sample of CBSM projects, supporting research, and this effort in the Lake Ripley watershed will show that CBSM can be a useful addition to the current arsenal of approaches.

State, National, and International Rain Garden Programs

Within Wisconsin and nationwide, there are a number of rain garden programs sponsored by government agencies, non-profit organizations, environmental consulting firms, and citizen groups. Most are educational, providing web resources and informational materials on building and maintaining rain gardens.

⁵ <http://www.cbsm.com/>



Literature and web-based searches on rain garden programs in other countries have been less productive. While Canada, Australia, and many European countries may have rain garden programs similar to those in the United States, there may be a difference in terminology that we are not aware of.

Wisconsin Rain Garden Projects

Wisconsin Department of Natural Resources

This website offers a large amount of educational and technical assistance. It provides many links to information about rain gardens within and outside of the DNR. You can find an explanation of what a rain garden is, a list of native plants appropriate for various levels of sun and shade, a 'how to build a rain garden' instruction manual and even educational resources for teachers. All of the links to other Wisconsin rain garden projects or educational sites were located in Madison.

<http://www.dnr.state.wi.us/org/water/wm/nps/rg/links.htm>

Dane County Office of Lakes and Watersheds

Dane County's website is also educational in nature. It provides an explanation as to what a rain garden is, why someone would build one, how to build and maintain one and provides a list of resources in PDF form and links to other regional rain garden websites. <http://www.danewaters.com/private/raingarden.aspx>

1,000 Rain Gardens Project

This is a project of the City of Madison Engineering Division. They simply pose the question: "1,000 Rain Gardens?" and let the reader know that they want to record all of the rain gardens in the city of Madison. As of April 2007 they are up to 158 rain gardens. This website appears to be a base for groups in Madison to present their rain garden projects. www.ci.madison.wi.us/engineering/stormwater/1000rg.htm

Edgewood Department of Natural Science

Edgewood is a private Catholic school located in Madison that offers education from preschool through college. Their website showcases six rain gardens that were built on their campus, which is near Lake Wingra. These gardens were installed from 2000-2003. This website also offers a very basic six-step guide for building your own rain garden, which includes more questions to ponder rather than step-by-step directions. Included in this guide is a cost estimation for construction, design, planting, and the purchase of plants. All of their rain garden links within Wisconsin were also within Madison, except for two websites of contractors who are in the business of installing rain gardens and the like.

<http://natsci.edgewood.edu/wingra/management/raingardens/>

Applied Ecological Services Inc.

This is one of the contractors Edgewood linked to in their rain garden website. Applied Ecological Services is a 17-year-old consulting, contracting, and restoration firm. They manage over 100 projects per year for all kinds of customers: from residents to foundations and governmental units. On their rain garden page they briefly describe the benefits of a rain garden and offer a link to the DNR's rain garden manual and three PDFs regarding rain gardens. www.appliedeco.com/RainGarden.cfm



Rain Garden Programs Outside of Wisconsin

10,000 Rain Gardens

10,000 Rain Gardens is a joint citizen-government initiative to improve urban storm water management practices in the Kansas City area. It is a “comprehensive public education plan” to engage citizens in the effort. The website offers a six-page Rain Garden Guide with instructions for performing percolation tests, siting and digging gardens, and designing planting arrangements.

<http://www.rainkc.com/home/index.asp>

Rain Gardens for Rock Island Program

The Rain Gardens for Rock Island Program is a cost-sharing and technical assistance program issued through the Public Works Department of Rock Island, Illinois. The city will pay citizens and business owners \$4.00 per square foot of approved rain garden if they follow the proper application and installation procedures outlined on the department’s website.

<http://www.rigov.org/citydepartments/publicworks/raingarden.html>

Rain Garden Network

The Rain Garden Network is a small company founded in 2003 to design, build, and maintain rain gardens for homeowners, schools, organizations, churches, and businesses in the Chicago area. The company partners with Citizen Solution, a citizen action and education program designed to target non-point source pollution problems, and Ecotone Digital Media, a website development company, to provide education and assistance to interested citizens and businesses. <http://www.raingardennetwork.com/>

University of Rhode Island Healthy Landscapes Program

The URI Healthy Landscapes Program is a collaborative effort with the university’s Cooperative Extension Home*A*Syst Program, the URI GreenShare Program, the URI Master Gardener Program, and the town of North Kingstown, Rhode Island. The project began in 2002 with the goal of developing and delivering an Extension education program to promote the implementation of pollution-prevention best management practices (BMPs). The program provides educational materials on rain gardens, emphasizing their ability to enhance home landscapes and improve local water quality.

<http://www.uri.edu/ce/healthylandscapes/raingarden.htm>

Rain Gardens for the Rouge River (Michigan)

Michigan’s Southeastern Oakland County Water Authority (SOCWA) has used grant money from the Rouge River National Wet Weather Demonstration Project to create a citizen’s guide to planning, installing, and maintaining rain gardens. The short guide contains a description of rain gardens and their function as well as “how-to-do-it” information and a native plant list.

<http://www.socwa.org/nature/PDF/Rain%20Gardens.pdf>



The Setting

The Lake Ripley Watershed

Lake Ripley and its watershed are located in the town of Oakland, in western Jefferson County, Wisconsin. The lake is situated just east of the village of Cambridge, Wisconsin and only about 20 miles east of Madison (Figure 3).

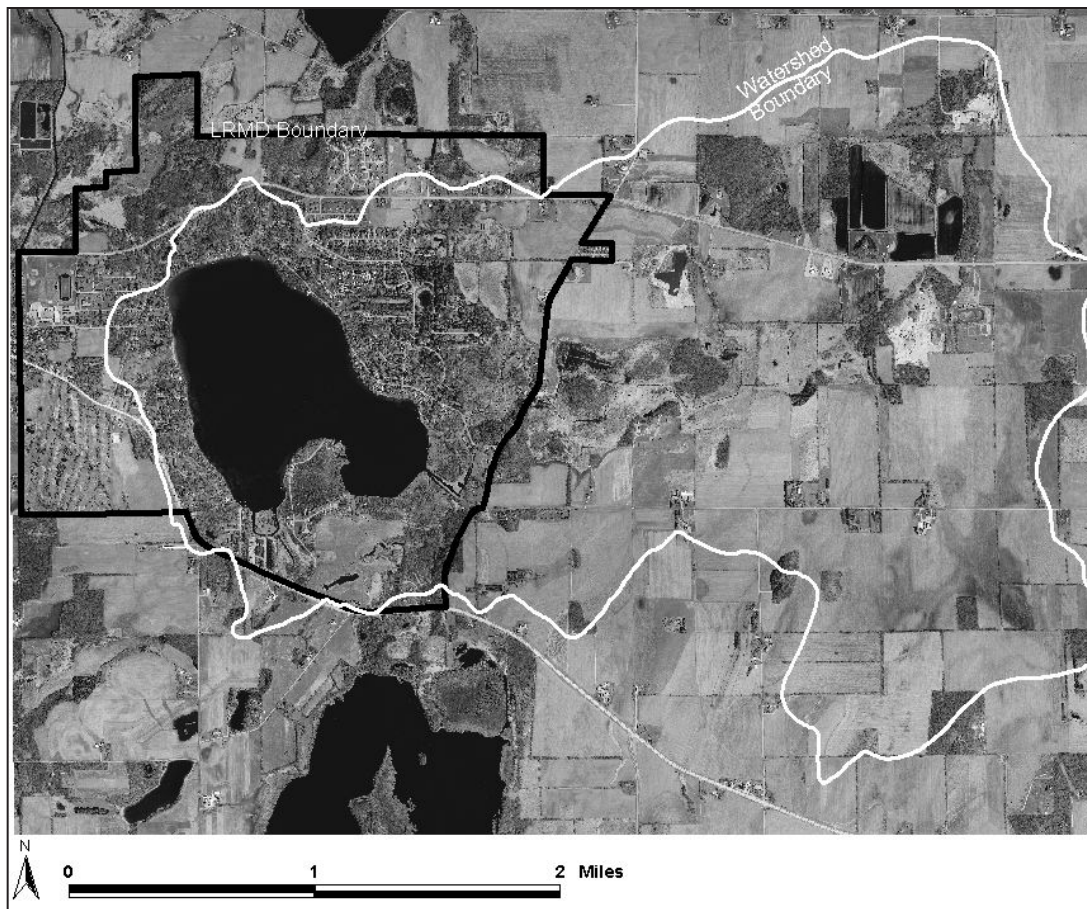


Figure 3. Lake Ripley Watershed and Management District boundaries. The thick black line is the Lake Management District boundary and the white line is the watershed boundary.

Source: Lake Ripley Management District.

Lake Ripley's watershed, or drainage basin, is about 5,100 acres (8 square miles) with a land area that extends more than 2.5 miles east of the lake. This adjacent land area drains surface water into Lake Ripley, which subsequently drains into Koshkonong Creek and portions of the Lower Rock River Basin. While Lake Ripley receives most of its water in the form of stream drainage from the surrounding watershed, groundwater accounts for at least 30% of the water being supplied to the lake. This groundwater input is critical for



maintaining water quality. Since the Lake Ripley watershed is of considerable size, the lake also receives a greater quantity of stormwater runoff, which carries with it excess nutrients and sediments from non-point pollution sources in the basin.

Historically, wetlands comprised a large percentage of the watershed, but now represent only 15% of the total land area, including woodlands and open water. Less than 400 of the original 1,500 acres of wetlands currently remain in the Lake Ripley watershed. These remaining wetlands provide valuable wildlife habitat, flood attenuation, and pollutant filtration. Expanding agricultural land use in this landscape has contributed to significant wetland loss (greater than 60%) and degradation due to filling, ditching, and draining. At present, 70% of the land area in the Lake Ripley watershed is in agriculture and 15% is residential. Residential land use is rapidly expanding and much of the shoreline development is concentrated within a one-half mile area surrounding the lake.

The Lake and Changes Over Time

Lake Ripley is a 418-acre glacial kettle lake. It is part of the Lower Koshkonong Creek and Lower Rock River drainage basins. The lake has one unnamed inlet tributary stream entering its southeast corner, and an outlet into Koshkonong Creek at its northwest corner. Although Lake Ripley has a maximum depth of 44 feet near its center, more than one-third of the lake area is very shallow at water depths of less than five feet. The extensive shallow water habitat on Lake Ripley supports a diversity of vegetation and wildlife, including 29 aquatic plant species and 34 fish species. The lake is also moderately to highly productive and nutrient-rich. Its trophic status oscillates between mesotrophic and eutrophic. A complete listing of Lake Ripley's physical, biological, and chemical properties is included in Tables 1 and 2.

Lake Ripley is heavily used for recreational purposes such as boating, swimming, fishing, and quiet enjoyment of natural scenery. This lake resource is shared by both residents and tourists alike, especially since it is within reasonable traveling distance of major cities such as Madison, Milwaukee, Rockford (IL), and Chicago (IL). There is only one boat launch that serves as a general access point for public use on the lake; all others are privately owned. There is also a community park and public beach access along the western shoreline of Lake Ripley. Sensitive shoreline habitat areas and wetlands are protected through town pier ordinances and the use of special slow-no-wake zones.

Due to the intensity of recreational usage on the lake and increasing development in the watershed, Lake Ripley has suffered ecological disturbances over time. Water quality has declined as a result of increased stormwater runoff, transporting sediment and nutrients to Lake Ripley. An increase in the percentage of impervious surfaces in urban areas has also



Table 1. Physical Properties of Lake Ripley.

Source: Lake Ripley Management Plan

Origin of lake:	Glacial kettle
Lake type:	Drainage (w/ one inlet & one unregulated outlet)
Surface area:	418 acres
Shoreline length:	4.85 miles
Mean depth:	18 feet
Maximum depth:	44 feet
Volume:	7,561 acre-feet
Hydraulic residence time:	1.17 years
Thermal stratification:	Dimictic (twice mixing)
Summer anoxic zone:	20-44 foot depths
Shoreline development index (lake shape):	1.7 (circle=1; number increases as lake irregularity increases)
Number of bays:	2
Inlet/outlet flow rates:	4.9/8.9 cubic feet per second (average annual for 1993)
Groundwater contribution:	30-45%
Watershed size:	8 square miles (5,120 acres)
Watershed-to-lake surface area ratio:	12:1
Watershed land uses:	70% agriculture, 15% residential, 15% wetland/woodland
Wetlands:	385 acres (1,500 acres in 1908)
Major soil associations:	Houghton-Adrian, and Fox-Casco-Matherton
Topography:	Mostly flat to gently rolling terrain
Inlet stream/main ditch length:	4.25 miles (2.5 miles in 1907)
Sediment loading sources:	Ditches (75%), shorelines (7%), construction sites (13%), cropland (4%), existing urban (1%)
Sedimentation rate:	1.3 centimeters/year
Public lake access:	1 improved boat launch
Sewer:	Municipal sewage treatment system

reduced the amount of infiltration and groundwater recharge occurring in the watershed. Additionally, boating activities have exacerbated problems with nuisance aquatic weed growth in the lake and in some cases have resulted in degradation of sensitive shoreline wetland areas.

Lake Ripley was selected as a Priority Lake Project in 1992 by the Wisconsin Department of Natural Resources (WDNR) through the Non-point Source Water Pollution Abatement Program. The lake received this designation based upon three criteria: (1) the lake was a valuable recreational and economic amenity, (2) it was significantly threatened by the effects of non-point source pollution, and (3) there was a high potential for overall improvement once appropriate pollution-control measures were implemented (Lake Ripley Management Plan). The technical and financial resources provided through this program directed the



Table 2. Chemical and Biological Properties of Lake Ripley.

Source: Lake Ripley Management Plan

Nitrogen to phosphorus ratio:	>27:1 (1993 average)
Limiting nutrient:	Phosphorus
Nutrient sources:	Watershed runoff (83%), atmospheric (9%), groundwater (8%)
Trophic status:	Upper-mesotrophic to eutrophic
Water quality indices:	Total phosphorus (“Good”); chlorophyll <i>a</i> (“Good”); Secchi transparency (“Fair”)
Nutrient sensitivity:	Low
Alkalinity & hardness:	High
Acidification sensitivity:	Low
Winter fish kill sensitivity:	Very low
Sport fisheries:	Largemouth bass, walleye, northern pike, panfish
Total fish species:	34 (1982 inventory)
Total aquatic plant species:	22 (1989 & 1991 inventories)

efforts of the Lake Ripley Management District to protect and improve the water quality of Lake Ripley by reducing non-point source pollution.

The Lake Ripley Management District

The Lake Ripley Management District (LRMD) was formed in 1990 in response to growing issues concerning the health of Lake Ripley. Its mission is “to protect and enhance the condition of Lake Ripley, while ensuring balanced and sustainable public use of the resource.” The LRMD is committed to serving property owners located around the lake and working on Lake Ripley protection and improvement projects. The activities of the LRMD are directed by a seven-member board of directors; five elected residents, and appointed representatives from Oakland Township and Jefferson County. District boundaries are depicted in Figure 3.

One of the goals of the LRMD is to eliminate sources of polluted runoff that reach Lake Ripley. The installation of rain gardens in residential areas is one solution that has been identified to accomplish this goal. The LRMD is working in cooperation with the University of Wisconsin to develop a community-based social marketing proposal for a pilot study that will promote the behavior of installing a rain garden among Lake Ripley residents. The LRMD has also applied for funding through the WDNR to fully implement this program.

The People in the Watershed

The population of the Lake Ripley watershed consists of part-time, seasonal, and permanent year-round residents. While the population varies throughout the year, summer



weekends draw a peak number of visitors to the lake. Within the Lake Ripley Management District and watershed boundaries there are approximately 915 address points. Of these properties, 675 are urban residences. There are also 151 lakefront residents that occupy Lake Ripley's shoreline. In October of 2005, a public opinion survey was distributed to property owners within the Lake Ripley Management District and/or Lake Ripley watershed to identify the concerns of residents regarding lake uses and management. There were 220 respondents from the 948 households receiving the survey, representing a 23% response rate.

The results of the survey revealed that the ratio of permanent (49%) to seasonal (45%) single-family residences is approaching 1:1 on Lake Ripley. Part-time or seasonal residents (30%) use their homes approximately 12+ days per month and a majority (62%) of them do not plan to make this their permanent residence. While over one-third of the respondents indicated they have owned property near the lake for greater than 20 years, at least 28% of those surveyed have purchased property over the past five years. This seems to support the observed growth trend in the community in recent years.

A large proportion of residents live either on the water (40%) or within a mile (47%) of the lake. When asked what prompted their decision to purchase property near Lake Ripley, the top three reasons provided were natural scenic beauty, water-sport opportunities, and quiet recreation. The top three activities enjoyed by the people of Lake Ripley include swimming, motorboat cruising, and fishing.

Clear water is the lake attribute of greatest importance for most people in the watershed followed closely by natural scenic areas and peacefulness. Safe beaches and having few to no problem weeds on the lake were other concerns. Most respondents (66%) perceive Lake Ripley's water clarity to be good (clear). However, they believe that invasive species, development pressure, and misuse of lawn/garden/farm chemicals threaten the condition of the lake. Most residents indicated that they are kept reasonably informed of news and information concerning Lake Ripley. The Ripples Newsletter was identified by 90% of respondents as the preferred source of communication. This newsletter will certainly be an important component to consider in the development of a community-based social marketing program.

Lastly, Lake Ripley residents participating in the survey were also asked to choose topics they would like to learn more about. Rain gardens received a ranking of 11th in the list of topics and were tied with nutrient/pesticide management planning. At least 13% of respondents indicated an interest in learning more about rain gardens. However, it is difficult to determine if lack of knowledge about rain gardens influenced these choices in any way.



The three most popular topics of interest were lake rules, general lake ecology, and invasive species identification and control.

The Environmental Problem

As development in south central Wisconsin continues to expand from metropolitan into rural areas, the surrounding water resources are threatened by increased development pressure.⁶ Increased development generates greater numbers of rooftops, driveways, streets, and sidewalks. This conversion of pervious surfaces to impervious has significant impacts on the watershed hydrology.⁷ The problem of increased impervious surface area is twofold because it impacts water resources both in terms of quality and quantity. In particular, increased impervious surface area leads to increased surface water runoff. When storm water flows over impervious surfaces, it picks up pollutants, nutrients, sediments and speed. These pollutants are then drained into surface water bodies and buffers to these water bodies, such as shoreline vegetation, are less effective due to the increases in runoff volume and speed. Increased impervious surface area within the watershed also leads to decreased rates of groundwater recharge of the underlying aquifer.⁸

A 2005 public opinion survey of Lake Ripley Management District property owners revealed that increased pollutant and nutrient loading and degraded water quality are of significant concern.⁹ Our CBSM program aims to address these concerns by encouraging the on-site behavior of installing and maintaining rain gardens.

Rain gardens are one way to manage storm water on individual parcels and to reduce the non-point sources of pollution that are currently the major sources of water pollution.¹⁰ If properly installed and maintained, these gardens will reduce surface runoff and increase infiltration which should, in turn, benefit water quality in the Lake Management District's water bodies.

Target Behavior Identification

The pro-environmental target behavior selected for the Lake Ripley watershed is for residents to install rain gardens on their properties. This behavior would require the residents to install a rain garden on their property in a location where it will intercept runoff from

⁶ US Geological Survey. (2004). Water-Resources Investigations in Wisconsin (Open File Report NO. 2004-1403).

⁷ Ibid.

⁸ Ibid.

⁹ Lake Ripley Management District [LRMD]. (2005). Lake Ripley Opinion Survey Results.

¹⁰ Infrastructure Systems Engineering. (2004). Implementing Rainwater Gardens in Urban Stormwater Management. [Capstone Project Brochure]. Maplewood, MN: Erin Laberee.



rooftops and local impervious surfaces, allowing water to infiltrate into the soil. The process of installing a rain garden for one property would involve the following major steps¹¹:

- 1) **Select a site for installation.** Considerations for selecting a rain garden site include determining which kind of slope, soils, size, and depth would be most appropriate for the property while maintaining garden efficacy, and proximity to the household down spout. This will take a certain level of familiarity with, and perhaps expertise in, siting a rain garden.
- 2) **Build the rain garden bed.** Considerations for rain garden installation include digging out and grading the garden and building a berm. The garden must be constructed in a way such that rainwater does not flow out of the garden and has time to infiltrate.
- 3) **Plant and maintain the rain garden.** Considerations for planting and maintaining a rain garden include selecting which plant species to use, the cost of plants and labor, and the timing of the flowering plants.

Here some familiarity with or expertise in native plants will be necessary for selecting suitable plants in terms of what is appropriate for the site and for creating a mix of plants that will have a succession of flowering times throughout the garden season—if a continually blooming garden is desired.

Selecting the target behavior

The overall goal of the CBSM project is to promote a behavior that will improve water quality in the Lake Ripley Management District. The selection of installing a rain garden as the target behavior was arrived at after a winnowing process that began with a range of behaviors that could conceivably improve water quality. Through a literature search of both scientific and educational materials, we found that the following list of behaviors have positive impacts on water quality. These behaviors were considered as potential target behaviors:

- Redirect roof downspouts
- Install and use rain barrels
- Install riparian vegetative buffers
- Use zero-phosphorus lawn fertilizer
- Reduce lawn fertilizer use and/or quantity
- Create and follow a nutrient management plan
- Steer motor boat use away from sensitive areas
- Encourage farmers to switch to conservation tillage practices
- Inspect boating equipment for aquatic invasive species
- Complete a backyard conservation assessment
- Plant native trees or shrubs for habitat

¹¹ US Geological Survey. (2004).



Installing a rain garden was ultimately selected as the target behavior considering the following criteria, which are explained in greater detail below (Appendix A contains summaries of research done by the URPL 969 class at UW-Madison on each of the above behaviors in relation to the criteria below):

1. Where the target behavior would be applied
2. Direct impact of target behavior on the environment
3. Potential magnitude of impact on the resource
4. Frequency of practicing the targeted behavior
5. Presence of external barriers
6. Opportunity for application of CBSM tools
7. Potential for incentives
8. Feasibility of monitoring the effects of the target behavior

Where the target behavior would be applied

Rain gardens could be installed both in a rural and urban context, although the literature suggests installing rain gardens in urban and suburban settings might have the most beneficial effect for reducing storm water runoff.¹² Taking this into consideration, there are 675 urban households within the watershed that could be targeted for a CBSM project involving the installation of rain gardens.

Direct impact of target behavior on the environment and potential magnitude of impact

Rain gardens have the capacity for intercepting and facilitating infiltration of runoff water, which would have a direct impact on the adjacent resource. The magnitude of this impact on water quality and infiltration has been documented in several studies.^{13 14} Installing rain gardens is consistently recommended as a Best Management Practice (BMP) for urban storm water management.¹⁵ Rain gardens have the potential for improving water quality by intercepting and infiltrating runoff water that would otherwise go into the lake.

Frequency of practicing the targeted behavior

Installing a rain garden is a one-time behavior, although maintenance will be required. There are multiple designs for rain gardens, each requiring a different amount of continued maintenance. A few examples of rain gardens of varying maintenance requirements are pictured in Figures 4, 5 and 6.¹⁶

¹² Ibid.

¹³ US Geological Survey. (2001). Evaluating the Effects of Urbanization and Land-Use Planning Using Ground Water and Surface-Water Models. (USGS Fact Sheet No. FS-10201).

¹⁴ Infrastructure Systems Engineering. (2004).

¹⁵ US Geological Survey. (2001).

¹⁶ Laberee. (2004).





Figure 4. A day lily rain garden is considered the lowest maintenance option, because of its use of a mix of hardy native and non-native vegetation, woodchip mulch for prevention of weed invasion, and it does not require fertilizer application. There is some concern with the ability of day lilies to invade natural habitats, but if the garden is kept within a turf-grass lawn, the chances of day lilies escaping are reduced.

Presence of external barriers

When implementing a CBSM program, external barriers to practicing the target behavior must be assessed.¹⁷ External barriers are those circumstances external to the individual (e.g. expense of practicing the behavior, unsuitable existing conditions for behavior, access to resources to practice the behavior) that prevent them from practicing the target behavior.¹⁸

External barriers that would prevent adoption of the target behavior include existing landscape characteristics that would not be appropriate for installing a rain garden (e.g. steeply sloping land, poorly drained soils, sites with minimal sunlight), costs for installation and maintenance of the rain garden, and dimensions of the lot that would not facilitate the installation of a rain garden (e.g. a small lot where it would be impossible to build a garden ten feet from the house).

¹⁷ McKenzie-Mohr & Smith, W. (1999).

¹⁸ Ibid.





Figure 5. A prairie garden involves the planting of native prairie grasses and forbs in areas that receive more than six hours of direct sunlight per day.



Figure 6. A shady garden involves planting shade-tolerant vegetation for areas receiving less than six hours of direct sunlight per day.



Opportunity for application of CBSM tools

A wide array of CBSM tools could be employed for employing the target behavior. These would include written (public) commitments, group (blocks, neighbors) commitments, effectively communicating the program through an already existing educational newsletter (Ripples), prompts and information kiosks or staff in local garden centers, and expanding upon already existing rain gardens to establish a norm. The choice of specific tools and how they would be implemented is dependent on the particular perceived barriers and benefits that are elicited from a sample of the target population.

Potential for incentives

Potential incentives for employing the target behavior could include cost sharing with the Lake Ripley Management District to cover costs of installation, increasing the personal enjoyment of the property through enhanced aesthetic quality, and increasing the property value with improved lake-water quality.

Feasibility of monitoring the effects of the target behavior

Monitoring the effects of installing rain gardens could be conducted, but would require a pre-installation survey of properties with obvious infiltration or runoff problems. Through surveying before and after installation, the effects of a rain garden could be specifically monitored on the property. Properties that have installed rain gardens could be surveyed to see if drainage or excessive runoff issues were still apparent. Indirect measurement could be derived from garden center staff interviews, product purchase tracking, or landscaper interviews. An approximate measure of the impact of the CBSM project on people could be carried out by surveying the number of rain gardens installed in the Lake Ripley Management District. The number of gardens would not necessarily be associated with the direct impact to the environment or Lake Ripley. There is certain to be a range of effectiveness for the gardens installed, as there are micro-conditions particular to each parcel where a rain garden may be installed that would affect the ultimate impact of the rain garden.

Our discussion ultimately came down to selecting between riparian buffers around the lake and installing rain gardens. Riparian buffers were considered because of ease of targeting the audience for the project. Riparian buffers can have two major forms; one of which involves landowners actually planting native vegetation to create a buffer. The other option is to simply allow a large section of lawn along the lakeshore to grow without mowing. These two aspects are attractive when creating a CBSM project because a limited audience allows for concentration of efforts and resources. In addition, the two buffer options would seem to attract two different sections of the target audience, allowing for a larger cross section of the audience to be reached.



As the benefits of rain gardens have been discussed above, it is time to move to the limitations of rain gardens. One of the limitations includes the ability to select suitable properties. There are certain specifications that a rain garden must meet in order for it to be effective at improving water quality. There are likely a number of properties in the watershed that are not physically suitable for installing a rain garden. Factors such as poorly drained soils, steep slopes, and existing lawn obstructions will render a property unsuitable for rain garden construction. Furthermore, the installation of rain gardens may require hard, physical labor depending on the site conditions.

In the end, rain gardens were selected for our target behavior. Several factors that were involved in this final decision involved our client, the Lake Ripley Management District. Paul Dearlove, the Lake Manager, was not in favor of the 'no-mow' type of riparian buffer, as the management district has been attempting to institute projects beyond the shoreline of Lake Ripley, and this behavior would be focused primarily on the shoreline inhabitants. No-mow riparian buffers were also discouraged due to their perceived poor aesthetics. These riparian buffers could be considered messy and weedy by landowners and there was concern that if some land owners were to choose to create no-mow buffers, a social norm discouraging riparian buffers might have been created. Furthermore, the management district already has a program to promote riparian buffers that Paul Dearlove considers to be successful.

The use of rain gardens allows residents to target the source of the runoff issue, in addition to involving a broader reach of residents in the Lake Ripley Management District. In addition, given the large number of rain garden projects going on across the state and country, we are presented with a prime opportunity to compare a purely educational rain garden project to a CBSM rain garden project.

Motivation, Opportunity, and Ability Analysis

Behavior can be described as a function of an individual's motivation, opportunity and ability to act.¹⁹ Motivation to act arises from the belief that self-interest is served. Opportunity refers to the presence of an environmental mechanism that allows an individual to act. Ability can be referred to as individual skill or proficiency in completing the desired behavior.²⁰ Understanding the motivation, opportunity, and ability of the target audience is critical in planning a CBSM project. An analysis of these behavioral components will provide insight as to whether or not the targets will be prone, resistant, or unable to behave and

¹⁹ Michael L. Rothschild. (1999). Carrots, Sticks, and Promises: A Conceptual Framework for the Management of Public Health and Social Issue Behavior. *Journal of Marketing*. October; 63, 4. pg. 24-37.

²⁰ Ibid.



will serve as a guide for selecting the most-effective tools to achieve the desired outcome.²¹

Given the complexity of the desired behavior, we anticipate that the motivation, opportunity and ability (MOA) of the target audience will vary widely. The MOA matrix (Table 3) represents an overview of the relationship between the target behavior of installing a rain garden, the target audience’s MOA, and the tools necessary to obtain the desired behavior.²² Based on the perceived benefits and barriers of the target audience, we have reason

Table 3. Motivation, Opportunity, and Ability Matrix for target behavior of installing a rain garden.

MOTIVATION	YES		NO	
OPPORTUNITY	YES	NO	YES	NO
ABILITY	1	2	3	4
YES	Prone to behave Install a rain garden <i>Education</i>	Unable to behave Install a rain garden <i>Marketing-CBSM</i>	Resistant to behave <i>Law</i>	Resistant to behave Install a rain garden <i>Marketing-CBSM</i> <i>Law</i>
NO	5 Unable to behave Install a rain garden <i>Education</i> <i>Marketing-CBSM</i>	6 Unable to behave Install a rain garden <i>Education</i> <i>Marketing-CBSM</i>	7 Resistant to behave Install a rain garden <i>Education</i> <i>Marketing-CBSM</i> <i>Law</i>	8 Resistant to behave Install a rain garden <i>Education</i> <i>Marketing-CBSM</i> <i>Law</i>

to believe that the target behavior can be placed in cells 1,2,4,5,6,7, and 8 of the table and that a combination of education and marketing tools will be necessary to achieve the desired behavior.

From our focus group discussions, it became apparent that there are likely a number of Lake Ripley residents who possess the motivation, opportunity, and ability to complete the desired behavior (cell 1), but education on how to do the desired behavior has been lacking or insufficient. Although it is clear that more-effective educational tools are certainly war-

²¹ Ibid.

²² Rothschild. (1999). pg 31.



ranted in this situation, we do not feel that education alone will motivate these individuals to act given the complexity of the behavior itself.

While it can be assumed that landowners concerned with improving water quality in Lake Ripley, especially those with lakefront property, will have the motivation to install a rain garden, many individuals may perceive that they do not have the ability and/or opportunity to do so (cells 2,5, and 6). These are the instances in which we believe CBSM is necessary to promote voluntary behavior by providing choices, creating new opportunities, and assisting with skill development.

We have also identified a subset of our target audience that we expect will have little self-interest or motivation for doing the desired behavior (cells 4, 7, and 8). This would include those who are already participating in a competing behavior, such as maintaining a turf-grass lawn, or those who do not feel a sense of connectivity to the resource the desired behavior affects. Additionally, we have reason to believe that this lack of motivation for our target audience is exacerbated by a perceived lack of ability and/or opportunity and not based on an outright refusal to comply. If the barriers associated with the lack of ability and lack of opportunity are removed using CBSM tools, motivation should follow.

Chain of Causality Analysis

A person's decision to act in a particular way is not a simple manner of choosing to do something instantly on the fly. Many factors are weighed against each other, and what may seem like an instantaneous process is actually a robust internal calculation of these different factors leading to a person's decision to act, or not. Gardener and Stern (1996) attempt to summarize this internal decision-making process as a chain of causality. This chain of causality, when complete, attempts to show that a person would act in a particular way. At the same time, if any one of the 'links' is broken, a person will not do the behavior in question. What follows is a summary of how the chain of causality for the residents of the Lake Ripley watershed might look like for the decision of whether or not to install a rain garden (Figure 7).

External Incentives and Constraints

In isolation from any thoughts on rain gardens, people will not be inclined to use them if there is a large barrier that is out of their control (e.g. reducing car use and oil prices). For the installation of a rain garden there are several places where external barriers may play a role: price of the plants used in the garden, price of labor/equipment if a contractor is used for the installation, etc. For Lake Ripley none of these, or other, external



Adapted from Stern and Oskamp, 1987

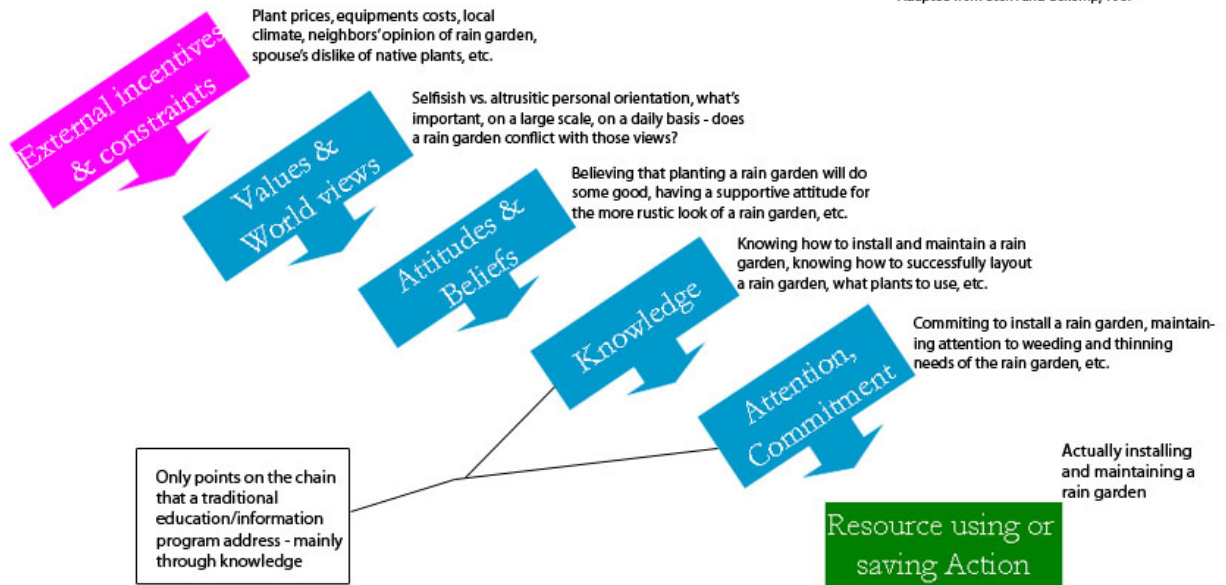


Figure 7. A brief summary of what a chain of causality may look like for a resident of the Lake Ripley Management District concerning the installation of a rain garden. Note that a typical education/information program only addresses the last two links of the chain, CBSM works with all links of the chain.

incentives/constraints come to bear. Plant costs are about equal to other options for a perennial garden. Moreover, financial considerations are a moot point if other elements in the chain of causality put a high value on installing a rain garden, as long as a person is of moderate means, since the installation of a rain garden can be done cheaply. Therefore, on the whole there are not any external barriers or incentives that truly affect a person’s decision to install a rain garden.

Values and World Views

What does a person consider to be important? What does a person think about the world around them? The two extreme answers for these questions are either not placing any interest in the world around them and only caring about one’s own concerns (egoistic), or placing others’ concerns above one’s own (altruistic). Most people would probably fall somewhere between these two extremes. At the same time, the use of a rain garden can fall between these extremes as well. On the one hand, a rain garden can be marketed in terms of personal benefits for one’s property. That is, the groundwater recharge, erosion control, increased land value, and an emphasis on personal enjoyment of gardening, could

all be stressed for those needing personal reasons for installing a rain garden. Alternatively, the benefits to groundwater quality improvement, lake-water quality, and wildlife habitat could be emphasized as benefits stretching well beyond an individual's personal backyard. With an increasing importance being placed on positive environmental views, in particular thanks to the issue of global warming, and perceiving oneself as an environmentalist, people may also be motivated to install a rain garden for more altruistic reasons. However, CBSM focus is on presenting perceived benefits and barriers in a manner that weights more heavily on the egoistic end of the spectrum. Keeping this in mind, going too far to either extreme is likely to alienate some portion of the target population.

Attitudes and Beliefs

This link of the chain is where people are most likely to begin to tend toward inaction with regard to installing a rain garden. Even with the two previous links of the chain in place, people must believe that a rain garden will actually contribute in a meaningful way to their values. Additionally, people must have a positive attitude, at the very least, to the idea of a rain garden on their property, and likely be amiable to the idea of working in the garden. Regardless of the facts supporting the installation of rain gardens, without an attitude or belief that a rain garden will accomplish something substantial, they will not install a rain garden. Several people during the focus group expressed that they did not see the reason to replace the ground covering they currently had with a rain garden—some being especially unclear on why a rain garden would be an improvement over turf grass. A favorable attitude toward the status quo combined with a belief that a turf lawn is perfectly fine from an environmental, social, and aesthetic view are key elements that will have to be addressed by the CBSM approach.

Knowledge

From the focus group results, this is by far the weakest link in the chain of causality. While some people had an idea of what a rain garden is, no one had a good grasp on how a rain garden works or how to install one on their property. This lack of knowledge, combined with poorly defined beliefs/attitudes concerning rain gardens, has a synergistic effect towards people being very unlikely to commit to any action. Without knowing how a rain garden works or how to install one on their property, people will have no motivation to do so if their attitudes toward rain gardens do not lead them to search out additional knowledge. The focus of the efforts of the CBSM project will certainly have to address both the knowledge and attitudes/beliefs links in the chain of causality. The most important point here is that there must be a combination of addressing Attitudes/Beliefs along with people's Knowledge. Without this approach there will be no individual drive to find and utilize information, resulting in nothing more than additional informational pamphlets sitting on shelves as the product of the effort to install more rain gardens.



Attention and Commitment

Once people are aware of the benefits of a rain garden they must be encouraged to commit to installing one on their property. Hopefully, a robust enough incentive system can be established so that commitments will not be difficult to obtain. A likely situation may be people working in partnerships with the Lake Management District or community groups on a cooperative rain garden project. In this way, commitments can flow from community planting days, people having volunteer help to plant rain gardens on particular days, or having a paid professional install the garden. This may also be a sticking point in the process of getting people to utilize rain gardens since sustained motivation can become a factor. “If it ain’t broke, don’t fix it,” as one of our focus group members commented. While this participant’s attitude connects back to some of the other links in the chain, the main point is that people may need a final push to get the garden installed—even if all the other links have been addressed. Fortunately, once the garden is installed on the property, people’s attention will be focused on it, at least occasionally. Without some level of attention the garden will fall into disrepair (just as an unkempt lawn can develop); however, our supposition is that if a homeowner has gone to the work and expense to install a rain garden, she will continue to maintain the garden to make good on the initial investment made by installing the garden.

The Lake Management District would also be a key player in maintaining attention and commitments. Through the newsletter and personal visits to properties, the district could express its own commitments to rain gardens and water quality. Thus, another very relevant question must be directed at the district itself, and its ability to keep rain gardens in the forefront of residents’ minds.

In the end, the last links of the chain of causality must be where attention is focused and efforts are directed as part of this, and arguably any, CBSM program. A lifetime of being conditioned to certain values and worldviews cannot be rapidly overturned by this or any project. Moreover, as the scale of a project increases, there may be a greater need to limit the scope and intensity of behavioral-change programs. This is a question that we face with our project as well. Moreover, most of the potential external constraints (e.g. plant and labor prices) are not within the district’s control directly, not to mention the fact that belief systems play a large role in the degree that these external barriers would prevent a person from installing a rain garden. Therefore, efforts should be focused on the “chain-links” that will likely be the most productive: Attitudes/Beliefs, Knowledge, and Attention/Commitment.



Current Competing Behaviors

Our group identified two behaviors currently practiced by the residents of the Lake Ripley watershed that will be competing with our target behavior of installing a rain garden: maintaining a turf-grass lawn, and allowing natural plant establishment with little management.

The most common competing behavior currently being practiced is maintaining a turf-grass lawn. Although we do not know the exact percentage of watershed residents who maintain mowed lawns, focus group participants have indicated that many homeowners in the area have lawns and take pride in the manicured appearance of their properties (Figure 8).



Figure 8. Example of the competing behavior of a turf grass lawn.

Source: <http://www.oznet.k-state.edu/hfr/HortImage/Kentucky%20Bluegrass%20Lawn.jpg>

We assume that many of the residents with lawns use fertilizers and herbicides to promote grass growth and control weeds (Figure 9). This assumption is supported by the work of our classmates carrying out a CBSM project pertaining to fertilizer use in the Lake Ripley watershed. Lawn fertilizers tend to vary in percentage-by-weight of nitrogen, phosphorus, and potassium. Some fertilizers are high in nitrogen and low in phosphorus, others have equal parts of all three nutrients, and some lawn fertilizers have no phosphorus at all. We assume that the type of fertilizer used varies by residence. Some residents probably select their fertilizers deliberately based on their concerns for water quality, cost-effectiveness, and the health of their lawns. Others may put less thought into the composition of the fertilizers they select. We assume that application rates and the frequency of fertilization also vary by residence. Our classmates studying fertilizer use in the watershed have



informed us that some of the residents hire lawn-care companies to apply fertilizers and pesticides rather than performing these tasks themselves. While companies such as Tru-Green ChemLawn claim to tailor their fertilization and pesticide programs to individual lawn needs, residents using these companies have less direct control over the treatments their lawns receive.



Figure 9. Example of the competing behavior of maintaining a turf grass lawn.

Source: <http://www.newconceptlawn.com/Fertilizing.jpg>

In addition to chemical weed-control practices, residents maintaining lawns employ mechanical and cultural methods to keep weed populations to a minimum. Mechanical weed control might include hoeing, digging, and pulling weeds from established lawns, or tilling soil prior to turf establishment. Cultural practices include mowing, watering, and cultivating. Residents of the watershed probably mow their lawns on a weekly to biweekly basis to maintain appearances and to allow for foot traffic and a variety of uses for their yards. Mowing at the proper height can also serve to control weeds. Most residents probably irrigate their lawns in periods of low rainfall to keep the grass green and to prevent weed infestation. It is possible that some residents use cultivation methods such as core aeration to reduce soil compaction.



While most residents of the Lake Ripley watershed probably maintain lawns or gardens around their houses, it is likely that some have allowed plants to establish on portions of their properties with little or no management. Landowners with wooded lots or rocky soils are more likely to have allowed natural plant establishment in their yards (Figure 10).²³ One of our focus group participants claimed she had allowed blackberries and wildflowers such as phlox to spread through the understory of her wooded lot. It is likely that what the participant identifies as phlox is the invasive flower, dame's rocket. This is a common misconception in the population and identifies a tangential barrier to our project in that it is likely that many residents in the Lake Ripley watershed are unfamiliar with native plants which are commonly used in rain gardens. Furthermore, it is likely that any yard left in a 'natural' condition is rife with exotic and invasive species, which, while not the focus of this project, are not desired in the Lake Management District either.

In contrast to high-maintenance turf-grass lawns, properties with natural plant cover require much less management. Nevertheless, residents with wooded lots may periodically remove or cutback herbaceous and shrubby understory plants, and property owners concerned about invasive plant establishment may weed their yards routinely. Weeding also improves the aesthetic appeal of an otherwise unmanaged property.



Figure 10. Example of the competing behavior of allowing existing vegetation to grow up in the yard.

Source: <http://academics.skidmore.edu/wikis/NorthWoods/index.php/R5>.



Target Audience & Context

While this project is meant to improve the water quality in the Lake Ripley watershed as a whole, targeting the entire population of the watershed with this project could prove to be problematic. A large target population would tend to diffuse the energy and resources dedicated to the CBSM project requiring a greater amount of both energy and resources to reach a large population than if a smaller target population is chosen. The smaller population could allow for more precisely targeted efforts permitting resources to be targeted to those areas that will have a significant bearing on the outcome of the project as a whole. However, it would seem that the smaller the target population, the more difficult it would be to utilize the CBSM tool of norms. Here we propose three possible methods for selecting the target audience for the CBSM project. Any one of these methods may be used or they may be used in combination to narrow the landowners in the Lake Ripley watershed down to a manageable target group.

Individual Parcel Targeting

Use this technique to identify which parcels of land would benefit from a rain garden. In order to do this we suggest that someone with knowledge of rain gardens and someone with knowledge of the watershed drive around the Lake Ripley watershed with a plat map and determine which parcels are suitable for a rain garden. Suzanne Wade, University of Wisconsin-Extension Basin Educator for Natural Resources, and Paul Dearlove, the Lake Ripley Lake Manager for the Lake Ripley Management District, are excellent examples of the type of individuals we are envisioning for this process. Alternatively, it would be possible to determine which land would benefit from rain gardens with a GIS map of the area. This would include analyzing the hydrology of the area to determine which areas around the lake contribute most significantly to runoff that enters the lake. An aspect of this analysis could also include determining those areas around the lake with the most impervious surface. These areas would be likely to produce the most surface runoff, however, impervious surface area analysis should be coupled with an analysis of hydrology to ensure that the runoff in areas with high levels of impervious surface affects Lake Ripley. This is the most extreme of the targeting measures and would allow for precise targeting of areas that would have the greatest impact on the project outcome and also on those properties that would be best suited for rain gardens. This would allow for precise allocation of resources, but also seems to preclude the use of norms, especially if the targeted parcels are spread out over long distances.

Target Areas of Social or Geographical Influence

This targeting method focuses on areas of land that would have the most social or geographical influence. A parcel with a rain garden would have social influence if the rain



garden helped to influence other watershed members to install rain gardens on their properties. Parcels with high social influence would likely be on land owned by groups or members of the community that are well respected or parcels that include many community members cooperating together to build a shared or continuous rain garden as well as parcels that are in heavy traffic areas visited often by community members (such as schools, places of business, parks and other public areas). Geographical influence refers to those land parcels where locating a rain garden would have the greatest positive benefit on water quality. This geographical method is less focused than the parcel-targeting plan. In this plan, small basins could be targeted that would also correspond roughly with neighborhoods. In this way, efforts would be spread to parcels that may have a smaller impact on the final outcome of the project; however, the total effort applied to the project would be more concentrated to areas that would have a major impact on the project. For example, efforts may be targeted to a particular valley or low area around the lake that has many houses within it. The effectiveness of rain gardens on the particular parcels in this area would have mixed effectiveness, but the area as a whole would be important to improving water quality. The primary perceived benefit of allowing the efforts applied to the project to be concentrated geographically and socially in this manner would be to increase the possibility of a pro-rain garden social norm being created. The areas to be focused on could be selected in the same manner as in the previous example.

Identify Willing or Influential Landowners as Targets

A final option to narrow down the targeted individuals for this CBSM project is to determine which watershed land owners are amenable to the idea of incorporating a rain garden in their property. Targeted individuals should be individuals who show an interest in rain gardens by attending informational, educational, or experiential rain garden workshops or respond positively to surveys. Other individuals to be targeted are those identified as leaders (block leaders) in their community or who have gregarious personalities and are likely to influence and motivate others to put rain gardens in on their property. The importance of a charismatic community member cannot be undervalued. Depending on the social structure of the community, more than one such individual may be needed if there are many distinct groups. An example for Lake Ripley would be a possible division between seasonal residents and permanent residents. Depending on how these groups segregate, any number of recruits may be needed to ensure that all social groups are reached.

These methods could be used in any combination, however we believe that a hybrid of the three methods would be most effective. Our recommendation would be to first target individual parcels with the greatest potential for positive impact and which are most appropriate for rain garden placement. Once these parcels have been identified, select the areas with the highest concentration of such parcels and determine a social/geographical



boundary of influence around those parcels. Once areas for the project have been selected, begin to recruit community leaders and charismatic, interested individuals in these areas to start the project.

Barriers and Benefits

Our group conducted a focus group meeting at the Oakland Town Hall on March 5, 2006 to identify some of the residents' perceived benefits and barriers to installing rain gardens on their properties. This step was carried out early in the CBSM program planning process as CBSM programs focus on the perceived barriers and benefits of behaviors. CBSM programs focus on the perceived barriers and benefits that are found in the area in which the program will be applied. There is no stock list of barriers and benefits to be applied to all situations. Paul Dearlove, Lake Manager for the Lake Ripley Management District, provided us with a list of names and addresses of all landowners within the lake's watershed. Working from half of this list (our counterparts working on the other CBSM program used the other half of the list), we called full-time residents in an attempt to find six to ten people interested in participating in our focus group. We created a script to guide us through our telephone conversations, and created a list of residents who were "very interested" in participating and others who were "potentially interested." In our effort to enlist participants, we mentioned that we would be providing sandwiches and refreshments at the meeting. Seven of those contacted made a firm commitment to come, and ten more claimed they might be able to attend. We followed up with reminder telephone calls the night before the meeting to ensure that the people who had committed would remember to come.

The focus group meeting began at six o'clock in the evening and lasted approximately one and a half hours. Six of the residents who committed by telephone attended the meeting. Of these participants, one was a farmer, one lived in a condominium, and two had properties with lake access rights. At the beginning of the meeting, we announced the following ground rules:

1. Please respect others while they are speaking. Everyone's opinion is valuable.
2. Only one person should speak at a time.
3. Everyone should participate. Please feel free to share your opinions and speak from your experience.
4. Although we will try to maintain momentum, we would like to get closure on questions before changing topics. If you feel you have not been heard or your statements were misunderstood, please speak up before we move on.
5. Finally, please turn off your cell phones before we get started.



We then proceeded with introductions, and had the participants provide brief written responses to three questions designed to assess their current understanding of rain gardens and the functions rain gardens serve. These preliminary questions were as follows:

1. Do you know what a rain garden is?
2. What would you say is the difference between a rain garden and a regular garden?
3. What is the purpose of a rain garden?

In the remaining time, we asked questions to identify each group member's perception of the benefits and barriers to installing a rain garden on his or her property. Our facilitator was careful to encourage participation by everyone, and we had assigned two note-takers to record all of the dialogue. The questions we asked were as follows:

1. Do you think it would be difficult for you to install a rain garden on your property, either alone or perhaps with some help from others? If so, what do you think would make that construction difficult?
2. Suppose you built a rain garden on your property.
 - i. How do you think the rain garden would affect your property and you personally in positive ways?
 - ii. What about negative effects? What are the downsides to having a rain garden in your opinion?
 - iii. How do you think your friends and family would feel about a rain garden on your property? Your neighbors?
3. If you had a rain garden, what kind of impact do you think it would have on the water quality of Lake Ripley? Significant, insignificant, somewhere in-between? Do you think that this impact would be enough to motivate you to install a rain garden on your property? Why or why not?
4. Given everything that we have talked about this evening, what do you think would be the single greatest obstacle to you actually building a rain garden on your property? On a related note, what would be the largest incentive for you to build a rain garden?

At the end, we thanked the participants for their valuable feedback and offered brochures and other resources to the participants if they were interested in obtaining more information on rain gardens.

Using the notes we had taken during the focus group session, we constructed a table of the residents' perceived benefits and barriers to building a rain garden as compared to the benefits and barriers associated with competing behaviors such as maintaining a turf-grass lawn or allowing natural plant establishment to occur (Table 4). The table lists broad categories of benefits and barriers that encompass the specific points made by focus group



participants. For example, the perceived barriers to building a rain garden fell into the categories of technical and financial assistance needs, lack of information about rain gardens and how to install them, and skepticism about the aesthetic value of rain gardens.

Table 4. Perceived benefits and barriers to installing a rain garden on residential property in the Lake Ripley watershed. This table was derived from the notes taken at our focus group meeting at the Oakland Town Hall on March 5, 2006.

	Benefits	Barriers
<p>Target Behavior: Installing and maintaining a rain garden</p>	<ol style="list-style-type: none"> 1. Increased infiltration of storm water 2. Wildlife habitat 3. Increased property value 4. Increasing popularity of rain gardens (conforming with norm) 5. Pride in improving surface and groundwater quality 	<ol style="list-style-type: none"> 1. Labor and equipment needs 2. Monetary cost of labor, equipment, and plants 3. Lack of understanding about rain gardens and their functions 4. Lack of knowledge about how to install and maintain rain gardens 5. Concerns about aesthetics 6. Requires a change in behavior
<p>Competing Behavior 1: Maintaining mowed turf grass</p>	<ol style="list-style-type: none"> 1. Uniform maintenance 2. No change involved 3. Aesthetic appeal 4. Many possible uses 	<ol style="list-style-type: none"> 1. Labor intensive 2. Monetary cost of fertilizers, herbicides, labor, and equipment 3. Erosion and other storm water runoff concerns 4. No sense of pride in protecting water quality
<p>Competing Behavior 2: Allowing natural plant establishment in yard</p>	<ol style="list-style-type: none"> 1. No labor involved 2. Practical 3. Aesthetic appeal 	<ol style="list-style-type: none"> 1. Plants may be invasive 2. Lack of control over positioning 3. Lack of control over blooming times



We have identified maintaining mowed turf grass and allowing natural plant establishment as competing behaviors, but realistically there are not many situations in which building a rain garden would be mutually exclusive with another type of behavior. Residents with lawns will not be required to remove all of their turf grass to make room for a rain garden, and those with wooded lots will not have to remove trees or excavate large portions of their properties. Given the nature of our target behavior, we will not focus our efforts on decreasing the benefits and increasing the barriers to the two “competing behaviors” we have listed on the table. Instead, we will center the design of our CBSM project on increasing the benefits and decreasing the barriers to installing and maintaining a rain garden.

The three most common perceived benefits to building a rain garden mentioned at our focus group meeting were wildlife attraction, possible property value increases, and increases in infiltration. Many participants believed rain gardens would aid in erosion control and some thought that rain gardens could improve the quality of their drinking water. Almost all of the participants believed their friends, families, and neighbors would approve of their installing a rain garden, and many said they could take pride in maintaining a rain garden on their property.

The barrier mentioned most frequently during our focus group session was a lack of knowledge of how to create a rain garden. This stems from both the perceived inability to create a rain garden and misconceptions about the function of a rain garden. Furthermore, it suggests a basic unwillingness to begin to learn about rain gardens. This may be primarily a matter of entropy, as our focus group responded well to the idea of rain gardens on their properties. The other two barriers most frequently mentioned were aesthetics and difficulty in placing a rain garden given current yard conditions. These two barriers are related in that both are perceived as external barriers blocking a seemingly willing participant from constructing a rain garden.

Our focus group was not entirely representative of the target population. All of our participants were college educated, one worked for a nature preserve, and another was a stormwater engineer. Due to this skew in our focus group, we will not necessarily weigh the perceived barriers that were emphasized during the meeting more heavily than those that were not mentioned as often. For instance, our focus group did not perceive the expenses associated with building a rain garden to be a significant barrier, yet this may be a large factor in the decision-making process of other residents in the watershed. It is also likely that some people will associate rain gardens with nuisance wildlife such as rabbits and mosquitoes. To identify perceived benefits and barriers for a wider population, we have designed a questionnaire to mail to the residents of the Lake Ripley watershed and management district. The questionnaire and cover letter for the questionnaire are attached in



Appendix B. For further instruction in how to conduct the questionnaire and how to analyze the data gathered with the questionnaire we recommend referring to *Mail and Telephone Surveys: The Total Design Method* by Don A. Dillman.

Tools for Change

The full array of CBSM tools—communication, commitment, incentives, norms, and prompts—will all be utilized in promoting the target behavior of installing and maintaining a rain garden. In the following section, we describe the specifics of how each tool will be used and discuss the usefulness of each tool in overcoming specific barriers to the target behavior. We also suggest a detailed strategy for the implementation of a CBSM project in the Lake Ripley Management District.

Step 1: Identifying target properties

It will be important to narrow the target audience by selecting properties that are well suited for rain garden installation. Small, irregularly shaped lots and steep slopes may prohibit the installation of rain gardens in some areas. Knowledgeable Lake Management District and UW Extension staff should review topographic maps to identify slopes and drainageways prior to conducting field assessments of properties potentially suited for rain gardens. Gently sloping areas with relatively thin tree cover should be prioritized for assessment by Lake Management District staff. Field assessments can be conducted from a vehicle to confirm whether parcels are appropriate rain garden sites. The staff should designate neighborhoods or groups of properties deemed suitable for rain gardens as target areas for the CBSM project. Physical appropriateness of neighborhoods or groups of properties should not be the only criterion used to determine the target audience. Social factors, such as the presence or lack of self identified communities will be important, as will the presence of motivated, charismatic individuals to lead the effort in target areas. The presence of these two factors will help to create social norms favoring rain gardens, norms will be discussed in more detail below.

Step 2: Designing Effective Tools

There are several guidelines to follow in order to design effective CBSM tools.²⁴ Keep these in mind as you read through the recommended tools and refer to the list if tools need to be modified. They are as follows:

Effective Commitments:

- Emphasize written over verbal commitment
- Ask for public commitments

²⁴ McKenzie-Mohr & Smith. (1999)



- Seek group commitments
- Actively involve the individual
- Consider cost-effective ways to obtain commitments
- Use existing points of contact to obtain commitments
- Help people view themselves as environmentally concerned
- Do not use coercion

Effective Prompts:

- Make the prompt noticeable
- Should be self-explanatory (i.e. should explain simply what the person is to do)
- Should be presented as close in time and space as possible to the target behavior
- Encourage people to engage in positive behaviors rather than to avoid environmentally harmful actions

Effective Communication:

- Make sure the message is vivid, personal, and concrete
- Know the attitudes and beliefs of your intended audience
- Have your message delivered by an individual or organization that is credible with the audience you are trying to reach.
- Frame your message to emphasize what the individual is losing by not acting rather than what he or she is saving by acting
- If you use a threatening message, be sure to couple it with specific suggestions for action the individual can take
- Depending on the knowledge of your audience about a particular issue, use either a one-sided or two-sided message
- Make your communication, especially instructions for a desired behavior, clear and specific
- Make it easy for people to remember what to do, and how and when to do it
- Integrate personal or community goals into the delivery of your program
- Model the activities you would like people to engage in
- Make sure that your program enhances social diffusion by increasing the likelihood that people will discuss their new activity with others
- Where possible, use personal contact to deliver your message

Effective Incentives:

- Consider the size of the incentive (i.e. large enough to be attractive to the individual)
- Consider non-monetary incentives and disincentives
- Closely pair the incentive and the behavior
- Reward positive behavior



- Make the incentive visible
- Be cautious about removing incentives
- Anticipate peoples' attempts to avoid disincentives
- Provide feedback at both the individual and community levels about the impact of the sustainable behaviors

All of these factors were considered while we created the array of tools below, however it will behoove the program implementers to keep these criteria in mind as the tools are applied to the Lake Ripley area. This is especially important if any of the tools have to be modified to better meet the implementation demands in the Lake Ripley area.

Step 3: Information dissemination and communication

As stated in the benefits and barriers analysis, the barrier mentioned most frequently during our focus group session was a lack of knowledge of how to create a rain garden. This stems from both the perceived inability to create a rain garden and misconceptions about the function of a rain garden. To overcome this obstacle, the Lake Management District should hold a series of informational workshops on rain gardens in the early spring. The workshops should be announced in Lake Management District newsletters, on local radio stations, and on fliers in local schools, churches, and grocery stores. Each of the workshops will introduce new subject matter, moving from basic information about rain gardens to practical demonstrations of site preparation and planting. Residents should be encouraged to attend any of the workshops that are of interest to them. These workshops should be designed and presented in order, but as separate modules so that interested parties can attend them *a la carte*. Those with little knowledge of rain gardens would benefit greatly from the early informational sessions.

Workshops should be held at a convenient time on weekends, each lasting no more than one hour. We propose the following series of five workshops to be held in a bi-weekly series from mid-March to late April:

1. Rain Garden 101

This workshop will take place in the Oakland Town Hall or other acceptable community center and will offer an introduction to rain gardens to any interested citizens. The Wisconsin DNR and UW Extension have published an informational brochure titled "Rain Gardens: A household way to improve water quality in your community."²⁵ This brochure should be distributed to workshop participants for their future reference.

In a brief presentation, Lake Management District staff should define what a rain garden is and explain its basic purpose. A rain garden should be defined as a shallow depression planted

²⁵ Available as a PDF at <http://clean-water.uwex.edu/pubs/pdf/home.gardens.pdf>



with native wildflowers, shrubs, or grasses to absorb rainwater and encourage infiltration. The presentation should emphasize the following seven functions of rain gardens, many of which relate to the perceived benefits identified in our focus group session.²⁶ It will prove beneficial to relate these functions in terms of their benefits to those who install rain gardens and not necessarily how the functions benefit the greater community. Focusing on how rain gardens benefit those who install them will make the behavior change more enticing to all parties. Rain gardens:

- a. Increase the amount of water filtering into the ground, recharging the groundwater and reducing the amount of pollutants running off to lakes and streams
- b. Help sustain adequate flows in streams during dry spells
- c. Provide valuable wildlife habitat
- d. Enhance the beauty of your yard and neighborhood
- e. Help protect communities from flooding and drainage problems
- f. Help protect streams and lakes from damaging flows and reduce erosion of streambanks and lakeshores
- g. Reduce the need for costly municipal storm water treatment structures

Workshop leaders should also emphasize that there are different types of rain gardens to suit different soil and shade conditions and different levels of maintenance (Types of Rain Gardens, Appendix C). Plant selection and rain garden maintenance will be the topics of future workshops.

The last half of the workshop should be dedicated to an informal question and answer session.

2. Planning for Planting

This workshop will discuss the many types of native plants suitable for rain gardens in southern Wisconsin. It will again take place in the Oakland Town Hall or other community center. Participants may choose to learn about plants that require little maintenance, that are shade- or drought-tolerant, or that would do well in particular soil conditions. Rather than a lecture-style format, this workshop should be entirely interactive. Four tables should be stationed throughout the meeting room, each with color pictures of a particular type of rain garden and copies of plant lists pertinent to the type of garden on display. If possible, actual examples of the plants should be provided. Lake Management District staff and volunteers should be stationed at each of the tables to answer questions.

The first table should display pictures and information about shady rain gardens, the second should have information on low-maintenance gardens, the third should cover prairie and full-sun gardens, and the fourth should suggest plants for attracting wildlife such as birds and butterflies. Appendix C contains sample pictures and descriptions of different types of rain

²⁶ Adapted from the Wisconsin DNR and UW-Extension brochure "Rain Gardens: A how-to manual for homeowners" available as a PDF at <http://learningstore.uwex.edu/pdf/GWQ037.pdf>



gardens.²⁷ These materials should be available to workshop participants at each of the four stations.

3. Laying the Foundation

The third workshop will take place at a site designated for a demonstration garden. Ideally, this garden will be located in a public space such as a church or schoolyard. Lake Management District staff will spend approximately one hour demonstrating techniques in site excavation and soil preparation. This should be a hands-on learning activity, and all workshop participants should be encouraged to help.

Workshop leaders should follow the steps outlined on pages 1-15 in the WDNR publication "Rain Gardens: A how-to manual for homeowners."²⁸ Copies of this document should be available to workshop participants at the beginning of the meeting. According to Paul Dearlove, the design of the rain garden should meet the following specifications to be eligible for cost-sharing:

- a. The minimum rain garden size is 100 sq. ft. (as measured by the flat infiltration area). The rain garden shall be sized in accordance with soil types and expected runoff volumes, and as per guidelines set forth in DNR publication PUB-WT776 2003 (pp. 8-10).
- b. Soils shall be of suitable infiltration quality to prevent sustained ponding of water. Soils with high clay content shall be appropriately engineered to eliminate standing water within 24 hours of a rain event.
- c. The rain garden shall be appropriately positioned, shaped, and swaled to effectively intercept and contain targeted runoff volumes.
- d. The rain garden shall be constructed with a level base.
- e. The rain garden shall be 3-10 inches deep (in addition to the mulching depth), depending on the size of the area draining to the garden and the slope of the yard.
- f. The rain garden shall not be built directly over a septic system or sewer lateral, or directly under or adjacent to any mature trees.
- g. The rain garden shall not be built in a location where the groundwater table is in close proximity to the soil surface.
- h. The rain garden shall not be built within 10 feet of a house to avoid water seepage into the foundation.
- i. The rain garden shall not be built in an area that is deprived of sufficient sunlight to support robust plant growth.
- j. The rain garden shall not be placed in an area that receives heavy foot traffic.

Workshop participants should be given a copy of this list at the end of the session.

²⁷ The DNR has developed plant lists for a number of types of rain gardens and PDFs of these lists are available at: <http://www.dnr.state.wi.us/org/water/wm/nps/rg/RaingardenPlantList.pdf> and <http://www.dnr.state.wi.us/org/water/wm/nps/rg/plants/shady/ShadyRGPlantList-photos.pdf> These are just examples and other plant lists are easy to find with an internet search. Caution should be taken to ensure that the plant lists found are appropriate for the climate where the rain garden is to be installed.

²⁸ Available as a PDF at <http://clean-water.uwex.edu/pubs/pdf/home.gardens.pdf>



4. Planting Your Rain Garden

This will be another outdoor workshop, held at the site of the newly excavated demonstration garden. Prior to the workshop, Lake Management District staff should purchase plugs of species that are well suited to the shade and soil conditions at the demonstration garden site. Workshop participants should be introduced to all of the species being used in the demonstration. They should also be encouraged to help lay out the planting design and install the plugs. Workshop leaders should follow the steps outlined on pages 16-29 in "Rain Gardens: A how-to manual for homeowners" as they demonstrate layout and planting techniques.²⁹ Participants who attended the second workshop might already have plans for the plants they intend to use, but those who are unprepared may look to the short plant lists suggested on pages 18-29 of the how-to manual for ideas.

At the end of the workshop, leaders should give participants information about local garden centers and nurseries that carry native plant species. The Lake Management District is also encouraged to buy many plants in bulk prior to the workshop so that it may sell the remaining plugs to workshop participants and other residents at a discounted rate. Paul Dearlove cautions that landowners must comply with the following two planting guidelines to remain eligible for cost-sharing:

- a. The rain garden shall be planted with dormant plugs or actively growing nursery stock. Plants shall be native perennials and shall be planted at a rate of one (1) plant per square foot. Rain garden plants shall consist predominantly of native sedges, rushes, grasses and forbs (of multiple species) suitable for the particular site conditions.
- b. The entire rain garden shall be mulched with hardwood mulch after planting.

5. Maintaining Your Rain Garden

The final informational workshop will be held at the Oakland Town Hall. Returning participants should be asked to bring their copies of "Rain Gardens: A how-to manual for homeowners" to the meeting, but extra copies of the document should be available for new participants.³⁰ Lake Management District staff should offer a brief summary of the rain garden maintenance section on page 17 of the manual, and then offer to field questions from workshop participants.

Participants should also be aware of the following maintenance requirement to be eligible for cost-sharing with the Lake Management District:

The rain garden shall be maintained as follows: During the first 2-3 months of establishment the garden will require, at a minimum, watering on a weekly basis (depending on weather). After the first season of establishment, the garden should not require watering. In the spring of each subsequent year, the remaining dead vegetation shall be removed to allow for new growth, and any accumulated sediment (normally at the entrance to the garden) shall also be removed. At least two (2) times during the growing season the area should be weeded and additional hardwood mulch shall be added as needed to assist in weed suppression.

²⁹ Available as a PDF at <http://learningstore.uwex.edu/pdf/GWQ037.pdf>

³⁰ Available as a PDF at <http://learningstore.uwex.edu/pdf/GWQ037.pdf>



Other Communication

In addition to conveying information, another aim of communication within the context of a CBSM project is to influence the attitudes and behaviors of the target audience.³¹ Not only will information about rain gardens need to be disseminated, but once behavior change begins to take place this should be conveyed to the population. In addition, the affects of the behavior change should also be conveyed so that people can see that they are having an effect.

There are a myriad of ways in which to convey both of these types of messages. Create a map to be displayed in a community center that shows the locations of rain gardens that are being installed within the Lake Management District. Displaying your rain garden on the map would not be mandatory, and property owners would have the option of not participating in this particular aspect of the project. The map would allow for gardens that are built in less visible locations, such as a backyard to be displayed to the public. This map would also tie in as an incentive and help to build a social norm, both of these types of tools will be discussed below.

Another communication would be a chart that displays statistics on the number of rain gardens installed to date and an approximate calculation of the cumulative amount of rain-water captured in all rain gardens in the Lake Management District. There is also the option of designing and printing a series of communication tools such as bumper stickers, mail-box stickers, or lawn signs. A suggested sticker or sign design is included in Appendix E. An alternative to the provided design would be to hold a design competition in the community or within the local schools. If such a competition is undertaken, the rules should incorporate the list of criteria for effective communications found in Step 2 of this section.

Step 4: Commitments

Studies show that there is often a gap between an individual's environmental values and the individual's behavior, and between knowledge of an issue and a behavior that would address that issue.³² Commitments, both written and oral, make the connection between the attitude and the behavior, and between the knowledge and the behavior.

Employing commitment as a tool of change in the CBSM process bridges the divide between values and practiced behavior and also increases the effectiveness of the information on a particular environmental issue.³³ By having an individual formally commit to practicing a

³¹ McKenzie-Mohr & Smith. (1999).

³² Ibid.

³³ Ibid.



desired behavior that aligns with their environmental values, the chances of the behavior actually being practiced are increased.³⁴ The Cognitive Dissonance Theory states that when an individual perceives their behavior as being self-motivated, they are more likely to not only practice the desired behavior, but to also continue to do so beyond the initial commitment period.³⁵

Recommended Commitments

Once a community member or group fully understands what a rain garden is, what it takes to install and maintain one, and verbally commits to installing one, we suggest that the Lake Ripley Management District attempt to get the community member to sign a written commitment form (Appendix D). An opportune time to promote this would be following the rain garden workshops. By signing a written commitment a person is more likely to follow through on their intention.³⁶ On the form the community member will have the option to allow the Lake Management District to announce the individual's name and commitment in a published newsletter. Again, if their commitment is made public, they are even more likely to follow through on the installation and maintenance of the rain garden.³⁷ These commitments can be published monthly, semi-annually, or annually in the newsletter. We recommend that the name and commitment be published no less than on a yearly basis to reaffirm their commitment in the public eye.

Step 5: Incentives

Incentives provide motivation to either perform an activity already engaged in more effectively or to begin engaging in an activity that is not already practiced.³⁸ When creating incentives it is important to remember that incentives not necessarily be monetary. Social incentives, such as approval of family, friends or neighbors, and public recognition can both be just as motivating as financial incentives.³⁹

Recommended Incentives

In order to persuade the community member or group to commit to installing and maintaining a rain garden, we suggest that the Lake Ripley Management District offer the participants incentives to commit. These incentives will be made available only to participants willing to sign the written commitment forms. We recommend offering material and labor/technical support, and cost-sharing incentives to help the participant initially build the rain garden. Examples of material cost-saving incentives would be to partner with local

³⁴ Gerald Gardner & Paul Stern. (2002). *Environmental Problems and Human Behavior*. Boston: Pearson Custom Publishing.

³⁵ *Ibid.*

³⁶ McKenzie-Mohr & Smith. (1999).

³⁷ *Ibid.*

³⁸ *Ibid.*

³⁹ *Ibid.*



businesses to sell materials at a reduced rate to participants. The Lake Ripley Management District could also purchase materials at a bulk rate and sell them to participants just above or at wholesale value. Benefits to the district selling the materials directly to the participants include: not favoring one local business over the other, and having the ability to provide the materials at the workshops. The Lake Management District may also partner with contractors who would be willing to offer competitive or discounted rates to those installing rain gardens. A list of these contractors should be published in the newsletter and on the Lake Management District's website.

Additionally, the Lake Management District should try to find groups and individuals willing to volunteer their time to help community members install, and if the volunteer support allows, maintain the garden during the first year. Volunteers may come from groups of retired individuals, girl/boy scouts or other youth organizations, individuals working towards becoming master gardeners, unpaid interns, and the like. A list of these volunteer groups should be published in the newsletters and on the Lake Management District's website. The Lake Management District should be available by phone, email, or drop-in visits from community members who have questions regarding technical aspects of their gardens. Occasional site visits may be required to fully aid these individuals.

Other incentives such as tax cuts, community recognition and awards may be implemented to increase the likelihood that the participant continues to properly maintain their rain garden. Community recognition could be promoted by providing the participant with a bumper sticker, lawn sign, or lapel pin that states that the individual has committed to installing and maintaining a rain garden. This reinforces the idea that if the individual perceives the behavior as self-motivated, they are more likely to follow through with practicing the behavior.⁴⁰

Step 6: Norms

Having clear and recognizable community standards, normative actions, are another way to help facilitate the promotion of rain gardens. Norms are one way that this rain garden initiative will not fizzle with a lack of money or if a few dynamic individual supporters leave the community. A well established norm will be perpetuated by the community itself. If a standard conduct of what a resident of Lake Ripley's watershed "should do" or what the generally perceived "right thing to do" with regard to rain gardens is established, then continuity and expansions of rain gardens should occur. A community norm highlights the difference between compliance with a program (achieved through a reward structure, such as tax rebates) and conformity with a program, which should not need a reward structure as people receive social benefits from participating in the established community standard.

⁴⁰ Gardner & Stern. (2002).



Successful norms are established through three steps: make the norm be highly visible, use the visible norm to establish modeling behaviors (behaviors that people will see and adopt), and finally use personal contacts to reinforce the norm.⁴¹

Using and Establishing Community Norms

The best place to begin establishing norms is within the different neighborhoods and subdivisions that make up the Lake Ripley area. As already mentioned, a major part of establishing a norm is that the norm must be visible. From our own focus group we know that people were mostly unaware that there was even a rain garden in front of the Cambridge town hall. A rain garden will not simply appear in every neighborhood in which the management district wills one to exist; landowners need to be willing to serve as demonstration areas for their neighbors. Therefore, in conjunction with the other tools discussed, a “block leader” for each neighborhood area should be established to serve as a model for people. Moreover, this block leader could be a resource of information for neighborhoods, ideally assisting the district by serving as a personal contact for people. The implementation of this part of establishing a norm could be accomplished by following an outline similar to this:

1. After finding areas in different neighborhoods appropriate for rain gardens, contact the most dynamic and personable landowners with the possibility of installing a rain garden
2. If the landowner is interested in having a rain garden, then the district could offer some benefit (free consultation, plants, labor, etc.) in exchange for a commitment from that person/family to serve as a block leader for rain gardens.
3. Serving as block leader, that landowner can serve as the management district’s liaison, encouraging other neighbors to install rain gardens, extolling the benefits of a rain garden, and generally serving as an advocate for rain garden programs.

Should no suitable person agree to serve as a block leader, then the personal contacts and behavior modeling will have to remain in the hands of the district’s staff and volunteers. In this less than ideal case, the sample rain garden at the town hall would have to become a much more celebrated and well known piece of the community’s environment. Moreover, personal visits to landowners who would especially benefit from a rain garden would have to be more pronounced, especially without any localized representation in the various neighborhoods.

Another approach would be to encourage neighborhoods to form a neighborhood group, if one does not already exist. In the case where such a group already meets, they could be encouraged to form a community rain garden rather than only on an individual’s land. Given the density of many of the homes in the area, this might be the only way for a rain

⁴¹ Ibid.



garden to be large enough to be effective. These groups of neighbors would be especially effective as conduits for the other tools by having the opportunity to establish their own commitment and incentives programs. For example, perhaps the community rain garden could feature a small dedication to those neighbors who helped to install the rain garden and/or installed rain gardens on their own property.

Two additional ways to establish a community norm both attempt to reach the entire Lake Ripley community. The first of these district-sponsored/organized events would be a “Seed or Plant Swap.” At the onset, since there are not many people with rain gardens currently in the community, this would be an event more to raise awareness and, if at all possible, provide some free native plant species to people. Eventually, the goal of this event would be to bring different rain gardeners together in camaraderie to exchange different varieties of plants, tips, and otherwise publicly acknowledge the effort to put in a rain garden. During the fall, around late September, people could be encouraged to collect some of the seed that their rain gardens produced to share with other rain gardeners. In the spring, a similar event would feature the exchange of young plants that were removed from the garden as part of occasional necessary thinning. Certainly, the district will accrue some costs from hosting these events, but the fringe benefit will be free plants for the community and the district to use. This will make the costs of plant materials negligible, and allow for the district to offer more technical assistance to more people to install rain gardens, because of the additional resources available.

A second suggestion for a potential event is a “Parade of Rain Gardens” hosted during the summer to coincide with the most native plants blooming. This activity would be similar to the parade of homes events that can be found in communities around the United States; essentially this event would be a tour of, and a contest among, local rain gardens. We envision this event to part of a larger community event, perhaps a Fourth of July celebration, so that people will associate rain gardens with the positive feelings that are generally part of community-wide celebrations. This annual contest will create an incentive for people to install and keep well-maintained rain gardens, along with helping to establish the community norm that rain gardens are fun, exciting, something worthwhile to do, and an everyday part of Lake Ripley. As with the seed/plant swaps, this parade will be more successful and interesting as more people install rain gardens, and this is also an entertaining way for people to find out about rain gardens in the local community.

There are certainly other options for establishing norms and events to help that process along, but these three suggestions were ones that we most strongly favored. The take-away points for the implementation of norms are the three standards: highly visible, part of model behavior, and followed up with personal contact. Many other options exist besides



what we have suggested, but we think that these suggestions are an excellent point of origin. Finally, the most substantial difference between establishing norms and the other tools is that a norm takes a long time to take hold, but has long-term effects. One can easily imagine the significance that is associated with long-standing community traditions, as well as the time that it takes for such a tradition to become established. Long-term planning with any work to establish a norm is imperative to the eventual successful establishment of a community standard.

Step 7: Prompts

Prompts can be used in order to remind people of their own commitments and persuade others to imitate them, with the goal of establishing a social norm.⁴²

Recommended Prompts

Yard signs and stickers can be used for this purpose (Appendix E). Signs placed in people's yards, stickers on windows, car bumpers and etc., can establish a sense of camaraderie among individuals with established rain gardens and prompt a reaffirmation of the sign or sticker user's own commitment.

Rain gardens sited in public places, such as schools, churches, and community centers can also serve as prompts. While this approach is not currently successful at the town hall, as evidenced by the focus group's lack of awareness of the rain garden at the town hall, placing rain gardens at several sites around the area will provide a broader coverage and make it more likely that residents will see the rain gardens. Another factor in the lack of awareness of the rain garden at the town hall also appears to be a deficiency in the understanding of what exactly a rain garden is. So while residents may have seen the rain garden at the town hall they did not know it was a rain garden. The educational programs will help to make prompts more recognizable.

Additionally, some of the methods used to establish norms, such as maps in public locations that identify established rain gardens and announcements of community members commitments, will also serve as prompts.

Monitoring and Evaluating the Success of the Pilot Study

Monitoring and evaluation of the proposed project strategies during the pilot-study phase are necessary components for developing a successful CBSM program. The purpose of conducting a pilot study is to assess the effectiveness of the CBSM program design using a smaller subset of the target audience and to make adjustments to the program before

⁴² Ibid.



implementing it on a community-wide basis.⁴³ The information that follows outlines important considerations for pre-pilot study evaluations as well as recommendations for short and long-term monitoring protocols.

Before beginning the pilot study, it is highly recommended that several focus groups of 5-6 people each be conducted to closely examine the proposed CBSM tools and strategies. Taking this additional step will help to ensure that the program design is well-suited for the Lake Ripley community before it is fully implemented.⁴⁴ Focus group members should be presented with an explanation of the proposed CBSM project and introduced to any materials that will be distributed during the pilot study, such as rain garden yard signs, stickers, and commitment forms. The focus group members should be asked to share their reactions to the proposed strategies, comment on any foreseen problems, or make suggestions for improvement. If the proposed CBSM program design receives positive feedback from the focus groups, the pilot study can proceed. If any major areas of concern are identified by group members, the plan can be fine-tuned before conducting the pilot study.⁴⁵

It is very important to keep in mind throughout this process that the key to evaluating the success of the pilot study is to determine whether or not actual behavior change has occurred as a result of the CBSM tools that have been employed.⁴⁶ To be certain that the CBSM program is bringing about the behavioral changes observed and not other external influences in the community, a control group which is not exposed to the program should also be included in the pilot.^{47 48}

Monitoring and evaluation efforts for this pilot project should be focused primarily on the number of rain gardens installed and not merely on changes in the perceptions and attitudes of Lake Ripley residents, as the installation of rain gardens is the behavior that this program is meant to promote. In order to appropriately measure the effectiveness of the proposed CBSM strategies on behavior change, baseline conditions for the behavior of installing a rain garden need to be established. The first step should be to determine the current extent and rate of rain garden installation in the program area prior to the start of the pilot program. The entire area to which the full CBSM program is to be applied should be surveyed so that an average extent and rate of rain garden installation can be determined. Using the average, an area with a typical density of rain gardens can be chosen for the pilot study, reducing the risk that the pilot study is conducted in an area that is non-representative of the greater program target. We believe that this rain garden density can be

⁴³ McKenzie-Mohr & Smith. (1999).

⁴⁴ Ibid.

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ Tools For Change Website. <http://www.toolsofchange.com/English/firstsplit.asp> accessed on April 16, 2007.



sufficiently documented through visual observations of sites within the study area, contact with residents that have rain gardens on their property, and any existing records of rain garden projects for which the district may have provided technical or financial assistance. We recommend that the Lake Ripley Management District use this information to create a monitoring database that tracks rain garden installations within the community and contains pertinent information such as property owner, location, date of installation, and any other site-specific facts worth noting. Visual site inspections should also be conducted regularly once the pilot study begins to evaluate the progress of the program and to ensure that those that have committed to installing rain gardens are meeting the proper design and maintenance specifications established for the community. An inspection of progress on rain garden commitments should be conducted at least once a season.

In addition to monitoring and evaluating actual changes in behavior, it is also important during the pilot study to assess the impact of the proposed CBSM tools. We highly recommend performing in-person follow-up surveys with all participants in the study to determine what influenced their change in behavior the most. Examples of other means to monitor the effectiveness of specific tools would include tracking the sales of rain garden supplies or kits from local vendors, conducting surveys of residents that have been exposed to prompts, and monitoring attendance at workshops or other rain garden-related events in the community such as plant swaps or the parade of rain gardens. Specific trends in this type of data may help to expose any CBSM tools that are not effective in promoting the desired behavior of installing rain gardens. Such tools can then be modified or eliminated from the final community-wide CBSM program.

Although there are a number of methods available to measure the success of this pilot study in the short-term, the measuring of long-term impacts of this CBSM program on the health of Lake Ripley and its watershed poses challenges. We feel that it will be critical for the community to receive feedback from the management district on how their change in behavior is positively affecting Lake Ripley. This feedback will serve to reinforce the appropriate behavior and contribute to the success of the program.

Given the nature of this project, the information necessary to provide adequate feedback to the community and other potential supporters of the project may be difficult to obtain without a prolonged period of data collection or intensive research on water-quality variables within the lake and its surrounding watershed. A simple way to begin informing participants of their impact would be to estimate how much water the collective rain garden area can capture and treat. Making this estimate available to the public in a visual manner, perhaps in a manner similar to community fund raising “thermometers,” would heighten the impact of the message as well. A further step would be to map and monitor runoff that



reaches Lake Ripley from the pilot study area, and the program area as a whole, when the program is fully implemented. This should be done before and after implementation of the pilot program so that direct impact on Lake Ripley can be assessed. As the most comprehensive package for monitoring, we suggest that the Lake Ripley Management District perform a complete assessment of the overall conditions (erosion, overland flow, sedimentation, water quality, nutrient load) currently found in the future pilot study area, document it, and continue to monitor it. If resources are available to do so, groundwater infiltration studies would also be extremely useful. This data then needs to be conveyed to the general public.

Over the years, the Lake Ripley Management District has worked to establish baseline water quality data for Lake Ripley and this effort should continue, especially over the course of the CBSM program. Since there are a whole host of environmental variables contributing to water quality in the watershed, it may be difficult to correlate any changes in these variables directly to the installation of rain gardens. However, this information will be useful for identifying watershed trends over time and in providing justification for continued support of the program. A more likely alternative for assessing the impact of rain garden installations on the watershed might be to calculate the percentage of impervious surfaces in the study area and use this information to estimate the volume of runoff reduced over time due to the infiltrative capacity of rain gardens.

Lastly, we believe that this project should include a citizen-monitoring program component to actively engage community members in local resource protection and help create more community buy-in. Citizen monitoring will also serve to promote a greater awareness of potential threats to the lake and increase the residents' sense of connectedness and responsibility to Lake Ripley and the resources it provides. The Lake Ripley Management District is currently working with the Wisconsin Department of Natural Resources to implement a citizen water-quality monitoring program. However, we would like to take this a step further and propose the development of citizen monitoring activities specific to this CBSM program. For example, photo monitoring stations can be set up throughout the study area, especially on problematic sites. Photographs can then be taken at these stations by citizens at regular intervals and following significant storm events to capture a visual representation of stormwater effects and changes in the landscape over time as the rain garden program is implemented. These sites need to be determined before the program begins as photos need be taken at these monitoring stations before the pilot study begins to document existing conditions. Photos should continue to be taken throughout the course of the study to observe any significant changes in the condition of the selected sites following the installation of rain gardens.



Appendix A

BEHAVIOR: Redirecting Down Spouts

This behavior addresses storm water that drains off rooftops. Storm water is redirected via down spouts away from impervious surfaces to vegetated areas. Benefits to the environment resulting from this behavior include improved stormwater quality by pollutant retention on site, increased groundwater recharge by maximizing infiltration, decreased runoff volume and flow, decreased flooding potential, and reduction in amount of potable water used for irrigation.

Criteria	Class comments and conclusions
Urban/rural/both? # of people?	Primarily urban setting, 700+ people.
Direct impact on environment?	Yes, immediate and direct impact.
Magnitude of + impact on resource?	For every inch of rainfall, you can expect to collect .6 gallons of rainwater for each square foot of roof area. For example, 1 inch of rain on 1,000 sq. ft. of rooftop creates over 600 gallons of stormwater. The # of gallons of water each year that can be directed away from the sewer system per household can be calculated as follows: Area sq. ft. X inches rain X 0.62 = Gallons of runoff per year. [Michigan example: A 1,500 sq. ft. home can redirect 25,000 gallons of water] The cumulative impact of an entire neighborhood redirecting down spouts to vegetated areas can be substantial. Nationally, the U.S. EPA has determined that poorly managed rainwater is responsible for 15% of lake impairments. Around more developed lakes, 50% of the rainwater becomes runoff. When impervious surface coverage exceeds about 12 percent, water quality is negatively impacted.
One time vs. repeated behavior	One time behavior, unless other attachments/actions may be needed (e.g. weeper, gutter extender or splash block).
External barriers to target population?	No. Is very simple and easy to do.
Opportunities for array of CBSM tools	Yes. Amenable to a variety of CBSM tools: education, prompting, commitment, norms, incentives.
Incentives potential?	Yes. Both financial and non-financial. Technical assistance could be offered. The District could reimburse homeowners \$xx per downspout with a \$ limit per home. Certificate program; being viewed by the community as a responsible waterfront property owner and land steward.



Other considerations	Site constraints: Where and in what direction should water be discharged? Is there an appropriate drainage location? Is a grassy lawn sufficient? Are soils sufficient for proper infiltration? How close to an adjoining property can a down spout be located to prevent ponding and/or basement leakage? (should be at least 5 ft away from buildings foundation) Since retention/detention of rainwater is key in this process for a positive result, should this behavior be coupled with a rain barrel or rain garden to be most effective?
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<http://www.cabmphandbooks.com/Documents/Development/SD-11.pdf>



BEHAVIOR: Installing Rain Barrels/Cisterns

Rain barrels are on-site water collection systems. They are 50-100 gallon plastic tanks placed under gutter downspouts to collect stormwater runoff from rooftops. Water collected in rain barrels can be used for watering indoor/outdoor plant, gardens, and lawns. It is distributed by force of gravity through a spigot at the bottom of the barrel.

Cisterns are partially or fully buried tanks with a secure cover and a discharge pump. They provide considerably more storage than barrels. Cisterns can collect water from multiple downspouts or even multiple roofs, and then distribute this water wherever it needs to go through an electric pump.

Urban or Rural?

Rain barrels are feasible only at urban/residential households. However, cisterns may be feasible in either realm. Specially, cisterns can be beneficial to agricultural landowners because they collect large amount of water that can be applied to a larger geographical area because of the electric pump.

Direct Impact on the Environment?

Both rain barrels and cisterns are used for water conservation and improvement of water quality. The collection of rain from impervious surfaces limits runoff that may transport sediment and nutrients into surface water bodies. The collection also helps users store water, making it available for use during drought conditions or times of peak water demand.

What is the Magnitude of Impact on Water Quality?

There was not much information available regarding the magnitude of rain barrels' impact on water quality. This is due to the lack of monitoring. Additionally, rain barrels are often used in conjunction with several other best management practices to improve stormwater quality. This makes it hard to get an idea of the influence of rain barrels alone. The only example I could find regarding rain barrels impact was in the Nine Mile Run Watershed in Pittsburgh. In this 6.5 square miles watershed (Note Lake Ripley Watershed is 8 square miles), engineering studies projected the need for 4000 55-gallon rain barrels to have a measurable impact on stormwater runoff. Such things as topography, density of housing, etc would influence this projection. However, it still indicates the large quantity of barrels necessary in a small watershed. Such calculations are also depended on residents maintain their rain barrel, so it is in proper working condition.

One-time or Repeated Behavior?

The actual installation is a one-time behavior. However, for the community to continue benefiting, residents will need to maintain their barrel. This includes using the water so the barrel has the available capacity for the next storm. Cisterns may be more of a one-time behavior because of the sheer volume of the tanks, as well as, the versatility to use the water.



What are External Barriers?

- The knowledge of making a rain barrel and properly installing one.
- The cost and space of installing a cistern.
- The lack of use for the water in the rain barrel.
- The presence of a resident to use the barrel (i.e. seasonal residents).

What CBSM Tools Could be Employed?

Social norms, public workshops on how to build a rain barrel, commitments by residents to install barrels, information in newsletter and agricultural supply centers on the benefits of installing a cistern on agricultural property

Potential Incentives?

The biggest incentive, whether a rain barrel or cistern, is free water. This incentive would especially apply to agricultural landowners who install a cistern to capture rainwater. Such landowners could collect enough water to significantly offset costs for irrigation. An incentive for lake users would be the quality of water for aesthetics or recreation.

Other Considerations?

Cisterns can be a large-scale project since they are typically buried or partially buried. This can be costly, but the amount of free water may provide enough incentive for some landowners to invest in this behavior.

Most rain barrels do not lead to mosquitoes because they are covered. Downspouts can connect directly to the barrel and there is an overflow spout to prevent.



BEHAVIOR: Building Rain Gardens

Urban or Rural? Number of Households?

Rain gardens could be employed in both rural and urban settings. Literature from scholarly journals and environmental advocacy groups specifically highlights and recommends their use in urban and suburban settings. Considering this, 675 urban households within the watershed could be targeted for a CBSM project focusing on rain garden construction.

Do Rain Gardens Have a Direct Impact on the Environment?

The consensus is yes; properly constructed rain gardens help direct runoff into areas specifically designed for better infiltration. Some filtration of pollutants carried in runoff has also been observed.¹

What is the Magnitude of Positive Impact on Water Quality/Infiltration?

Rain Gardens are consistently recommended as a BMP for urban stormwater management. One specific reason for this is the filtration of heavy metals that studies of rain gardens have shown. The retention of other water pollutants such as Nitrogen and Phosphorus-based compounds is questionable. Studies show moderate to minimal reduction of Total Nitrogen in filtered runoff and a minimal to increased levels of Total Phosphorus in filtered runoff.² Overall, expert opinion suggests that rain gardens provide good runoff control, but have less potential for improving water quality.

Changing a One-time or Repeated Behavior?

The construction of a rain garden is a one time behavior, but upkeep is required. Routine upkeep is not excessive.

What are External Barriers that would Prevent Adoption?

Land Characteristics may render rain gardens less effective or more difficult to introduce. Siting a rain garden on steeply sloping land poses a serious increase in the amount of work to be done to create the rain garden. Soils that contain a large amount of clay are not recommended for rain gardens. Costs do not appear prohibitive but large gardens or landscaped work could prevent some households from adopting gardens.³ Shady lots are not recommended. Lots where it would be impossible to build a garden 10 feet from house/foundation, or where the initial excavation for the garden would hit water would prohibit rain garden location.

What CBSM Tools Could be Employed?

Written (public) commitments, group (blocks, neighbors) commitments, effectively communicating the program through the Ripples Newsletter, prompts and information kiosks/informed staff in local garden centers, and building upon gardens already constructed (village hall) to establish a norm could be useful CBSM tools.

¹ Davis, et. al., 2001.

² Davis, et. al., 2001; Dietz and Clausen, 2004.

³ Self-created: \$3-5/ft², Landscaping Co.: \$10-15/ft². Rain Gardens of West Michigan, raingardens.org.



Potential Incentives?

The Lake Ripley Management District's Cost Share program could provide financial incentive for households to construct rain gardens. The aesthetic quality that rain gardens could add to one's property and, perhaps, the waterfront could add incentives their creation. Also physical help from one's neighbors, scout troops, local organizations or the WMU could overcome the barrier or physical labor.

Other Considerations?

Creating a CSBM project for the construction of rain gardens could be combined with other suggested projects such as redirecting drain spouts/drainage flows. Monitoring of the program could be done in a number of ways, but would require a survey of areas with obvious infiltration or runoff problems prior to execution. This way the program could be monitored by specifically examining these areas to see if problems have improved. The property of households/businesses that have built rain gardens could be surveyed to see if drainage issues or large amounts of runoff were still apparent. Alternatively, indirect measurement could derive from garden center staff interviews/product purchases and/or landscaper testimonial. Seasonality is important as well, as marketing should not occur in times where planting gardens would not be optimal (i.e., marketing should occur when people are planning gardening/yard work and not during the winter).



BEHAVIOR: Planting/growing vegetative buffers

Criteria:

1. Both urban (lakeside property owners) and rural (all land owners with property adjacent to a waterway). Involves approximately 160 people.
2. There is some controversy in the scientific community as to the direct environmental impact of buffers. Narrow buffers may not provide adequate protection against sediment runoff, and therefore are not effective in controlling phosphorus pollution. Buffers as wide as 100' may provide short-term control of phosphorus loading, but long-term management of phosphorus requires direct management of its sources (Wenger 1999). Most studies have shown that buffers are effective in controlling nitrogen pollution, however. Site-specific factors such as local hydrology, soil factors, and slope are critical in determining the effectiveness of buffers. Buffers may occur as unmowed strips of turf grass, grassed waterways, plots of native herbaceous vegetation, or forested riparian buffer strips (Fischer and Fischenich 2000). While tall, nonnative grasses may trap some sediment and nutrients, they would not provide wildlife habitat or have the aesthetic appeal of planted native buffers. Nonnative communities could also facilitate invasions of reed canary grass, hybrid cattails, and other aggressive opportunists.
3. The table below is taken from Fischer and Fischenich (2000); it summarizes findings from various studies with respect to the impact of buffers on surface water quality. Property planted with a buffer area of native vegetation around the lake would help to address some issues including: loss of wildlife habitat, shoreline erosion, and nutrient load into the lake (regardless of how effective a buffer strip is in slowing phosphorus there is still the simple fact that there would be less turf grass to be fertilized) (Henderson 1999). A large issue with regard to magnitude of effect depends on the number of people that install buffer areas and the size of their properties.
4. Planting native buffers is a one-time behavior, but the maintenance of any kind of buffer could be considered a repeated behavior (e.g. weeding, etc.). Viewing installation of a buffer as a repeating behavior could be advantageous since a planting could take a fair amount of time to establish itself, and continued maintenance would be necessary to guarantee the form and function of the buffer. If the buffer is seen as more than a one time project, then it would more likely achieve the effects desired.
5. Serious external barriers include the labor involved in planting new buffers, the cost of installing native plants (for buffers that are more than simply no-mow areas), and the public's knowledge of the lack of scientific consensus on buffers' effectiveness, width requirements, etc. Physical constraints might include steep slopes, inappropriate soil conditions, and the need for waterfront access. However, all of these constraints could be overcome through a combination of



CBSM techniques, and creativity in planning buffer installations. The only external barrier that may be too serious for CBSM to address would be the case of an extremely eroded riparian corridor or lakeshore that would require regrading by heavy machinery.

Table 1. Recommended Widths of Buffer Zones and Corridors for Water Quality Considerations

Authors	State	Width	Buffer Type	Benefit
Woodard and Rock (1995)	Maine	≥15m	Hardwood buffer	The effectiveness of natural buffer strips is highly variable, but in most cases, a 15m natural, undisturbed buffer was effective in reducing phosphorus concentrations adjacent to single family homes
Young et al. (1980)		≥25m	Vegetated buffer	25m buffer reduced the suspended sediment in feedlot runoff was reduced by 92%
Horner and Mar (1982)		≥61m	Grass filter strip Vegetated buffer strip	Removed 80% of suspended sediment in stormwater
Lynch, Corbett, and Mussalem (1985)		≥30m		30-m buffer between logging activity and wetlands and streams removed an average of 75 to 80% of suspended sediment in stormwater; reduced nutrients to acceptable levels; and maintained water temperatures within 1°C of their former mean temperature.
Ghaffarzadeh, Robinson, and Cruse (1992)		≥9m	Grass filter strip	Removed 85% of sediment on 7 and 12% slopes
Madison et al. (1992)		≥5m	Grass filter strip	Trapped approximately 90% of nitrates and phosphates
Dillaha et al. (1989)		≥9m	Vegetated filter strip	Removed an average of 84% of suspended solids, 79% of phosphorus, and 73% of nitrogen
Lowrance et al. (1992)		≥7m		Nitrate concentrations almost completely reduced due to microbial denitrification and plant uptake
Nichols et al. (1998)	Arkansas	≥18m	Grass filter strips	Reduced estradiol (estrogen hormone responsible for development of the female reproductive tract) concentrations in runoff into surface water by 98%.
Doyle et al. (1977)		≥4m	Grass filter strips and forested buffers	Reduced nitrogen, phosphorus, potassium, and fecal bacteria from runoff.
Shisler, Jordan, and Wargo (1987)	Maryland	≥19m	Forested riparian buffer	Removed as much as 80% of excess phosphorus and 89% of excess nitrogen

6. There are opportunities to use a variety of CBSM tools, including: commitment, education (addressing concerns of lack of knowledge on how-to install a buffer), prompts (perhaps in plant nurseries encouraging the purchase of native species or showing pictures of successfully installed buffers), and norms (once one prominent property owner or farmer installed a buffer others might follow suit)
7. Incentives may include involving local garden stores (providing rebates or deals on equipment and plants), cost-sharing, and offering help with buffer installation (creating volunteer groups, involving boy/girls scouts, etc).



8. Other considerations include the time needed to establish planted buffers, the cost of buffer installation, and the lack of aesthetic appeal of no-mow areas. Overall, buffer installation should be feasible (especially if buffers are defined as no-mow areas). Monitoring successful installations would also be relatively simple since it could be conducted through a visual appraisal of properties. Monitoring the ecological effects of the buffer strips would be more challenging since pollution would be reduced from non-point sources. Perhaps detailed surveys of some randomly selected pieces of property could be used as a basis of comparison for different characteristics (phosphorus loads, erosion, appearance, etc.) both prior to and following buffer installation.

References:

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BEHAVIOR: Zero Phosphorus Fertilizers

This behavior change requires that the targeted population use fertilizers that do not contain phosphorus. Phosphorus aids in root and cell development and the production of seeds. It is also the primary contaminant of the Lake Ripley Watershed.⁴ The targeted population will either need to own or rent land that they tend to with the application of fertilizer.

Criteria	Comment
Urban, Rural or Both / # of People	Both urban and rural. All people with lawns, gardens and/or farms that they fertilize.
Direct Impact on Environment	Yes, direct impact on the environment.
Magnitude of + Impact on Resource	<p>Most impact: change agricultural (70% of land) and home (15% of land) use of fertilizer to zero phosphorus</p> <p>Middle impact: change just agricultural use (70% of land)</p> <p>Lowest impact: change just home use (15% of land)</p> <p>Lowering the amounts of phosphorus that is let into the water table would improve the water quality. Phosphorus is a primary contaminant of water in many communities including and is the driving force behind Lake Ripley's algae and weed growth.¹² "A pound of phosphorus in a lake can result in 300-500 pounds of algae."³</p>
One Time v. Repeated Behavior	Repeated behavior
Serious External Barriers to Target Population	No serious external barriers that can not be overcome through CBSM tools.
Opportunities for Array of CBSM Tools	Education (displays in stores, literature, website), economic incentives (rebates), commitments (verbal and written), create norms, yard signs
Incentives Potential	Yes, financial incentives and the accolades of being a responsible community member.

⁴ <http://www.greenviewfertilizer.com/articles/eco-friendly-fertilizers>



<p>Other Considerations</p>	<p>As of March 2005, Michigan extension reported that it can be difficult to purchase the right kind of zero phosphorus fertilizers. Many zero phosphorus fertilizers available are fast release nitrogen fertilizers which are not recommended for home lawn care as they carry with them problems of large amounts of turf growth with lower levels of root growth, and the propensity to burn turf grass. Thus we need to make sure that the local stores would carry zero phosphorus fertilizers that are not fast release.</p> <p>Difficult to measure direct impact on water quality for the short-term. Could monitor local sales of zero phosphorus versus phosphorus loaded fertilizer.</p>
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BEHAVIOR: Reducing fertilizer application to match crop and/or landscape needs (e.g. reducing applications from five times per season to two times per season).

This would affect both rural and urban populations. The greatest potential impact on the lake will come from the agricultural sector, as it composes the majority (70%) of land area in the Lake Ripley Watershed. While the residential portion of the watershed is small (~15%), the proximity of the houses to the lake lends itself to providing a positive impact through reducing fertilizer application on residential lawns.

A change in this behavior would have a direct impact on the environment, namely the water quality of Lake Ripley. Increased P and N enrichment to freshwater systems is known to cause an increase the growth of algal blooms and aquatic weeds, increased eutrophication, decreased oxygen levels, and fish kills.

Measuring the magnitude of the impact on the resource: The literature states that the most effective means of managing nutrient loading to water bodies is to control the inputs of nutrients while implementing soil erosion management practices (Carpenter et al., 1998). Past studies have shown that through controlling the nutrient inputs into the system, total phosphorus concentrations in surface waters were reduced by 62-85%.

Measuring the magnitude of change following the change in behavior could be monitored through sampling surface waters for total phosphorus, and monitoring algae and fish populations. Because the Lake Ripley will already contain nutrients from nonpoint sources, the effects of this particular behavioral change may be difficult to detect immediately.

This would be a repeated behavior.

One external barrier to the target population includes the possibility that reducing fertilizer application rates would jeopardize the crop yield. Another barrier would be a situation where the farmer or resident is "locked in" a contract with a service company or cooperative, and the decision to change the fertilizer application rate is not their own.

This behavior change is amenable to a number of CBSM tools: commitment, using prompts, norms, education, and incentives.

Incentives (and Disincentives) potential: This behavior change is amenable to both financial and non-financial incentives. One incentive may involve increasing the visibility of the targeted behavior within the neighborhood or community through creating rewards for residents and farmers practicing the target behavior. Property owners could be provided with a sign to be placed in a yard or alongside a field that states, "I reduced my fertilizer use and look how good this looks", or something to that effect. Financial incentives could be provided to property owners to improve irrigation systems and to maintain their drainage facilities (to assist in the control of where the nutrient enriched water flows) through grants from the NRCS Environmental Quality Incentives Program (EQIP).



Residents and farmers are reminded that they can save money and time on not applying fertilizer as frequently. Another incentive is that there will be less “wear and tear” on their machinery and equipment. Promoting recognition for practicing the target behavior in the local, regional, and/or national farming community.

Other considerations include the possibility that some residents or farmers may not be willing to change behavior due to perceived risk of lost crop productivity or decreased lawn quality. While controlling nutrient inputs into the aquatic system is helpful, it is most effective to also incorporate the implementation of soil management practices.



BEHAVIOR: Use no-till and conservation farming

In no-till agriculture, the residue from the previous years' crop is left on the field after harvest. A no-till planter (grain or seed drill) is used to plant directly into the crop residue.

Criteria	Comment
Urban/Rural	Rural
Direct Impact on Environment?	Yes, sediment from soil erosion on these farms can reduce aquatic habitat quality and also carry excess nutrients and pesticides to water bodies. Leaving crop residue on the surface of the fields greatly decreases erosion and increases water infiltration, which will reduce runoff and nutrient loss.
Magnitude of + Impact on Resource	<p>Positive impacts to the watershed: less compacted soils enhance water filtration, residue left on fields from previous year's crop increase rain water infiltration of soils, both which result in decreased runoff, also there is lower nitrogen loss in runoff.</p> <p>Other positive impacts: reduced emissions due to decreased tractor use, causes carbon sequestration in soil, improves wildlife habitat, reduces soil erosion and soil compaction, improves soil quality and function (increased organic matter and retained water/earthworms).</p> <p>A study by a St. Olaf College student showed that runoff on conventionally farmed fields averaged 35 times that of no-till fields and 60 times that of rotation fields. Low levels of erosion on the no-till farm helped prevent nutrient loss, as nutrients can be lost from agricultural systems in eroded soil particles.</p>
One time v. Repeated Behavior	Repeated
Serious External Barriers to Target Population?	Cost (specialized seeding equipment needed for seed planting in non-disturbed/tilled soil)
Opportunities for CBSM tools?	<p>Education on proper no-till techniques;</p> <p>Prompts (on tools/equipments, either to not use the equipment, or to encourage strip tilling, i.e. no more than 1/3 of land tilled);</p> <p>Norms (target any farming coops, CSA farms, and local farming/agriculture groups/associations)</p>
Incentives Potential?	<p>Conformity incentive (conservation farming is becoming more socially popular);</p> <p>Monetary incentive (this popularity, coupled with, or perhaps because of, the fact that no-till farmlands are carbon sinks for power generator emissions, etc., can be supported by grants and awards) —there are already some existing programs in other areas to support conservation farming</p>



Other Considerations	Disadvantages/other barriers: If proper no-till techniques are not used, results in reduced crop yield; Increased herbicide use to inhibit unwanted shrub/plant growth; Possible long term erosion? drainage gulleys get deeper the longer that land is in no-till; Farmers are encouraged to till every several years to break up soil; Requires a huge mind shift for some farmers (...but we've always done it this way...)
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BEHAVIOR: No motor use in sensitive habitat areas of Lake Ripley

Criteria:

Group (Urban/Rural or both): Possibly both and probably an even larger area. Anyone who uses a boat with a motor on Lake Ripley would be the target community. This includes people who live around the lake and others who simply take day trips to the lake for boating purposes.

Direct Impact On Environment and Magnitude of impact on source:

(From the Minnesota Pollution Control Agency Website) The only study we know of looking at the impact of boat traffic on water quality is one done in 1996 by the Wisconsin Department of Natural Resources. The general conclusions from this report were that water clarity was temporarily reduced due to increased turbidity by nearly 10% on weekends, shallow lakes and near-shore areas are more affected than deeper lakes, and boat traffic may stimulate algal growth in lakes containing soft-water sediments.

Another Wisconsin study looking at the effects of motor boats on submerged plants, "Effects of Motor Boats on Submerged Aquatic Macrophytes," was printed in the Journal of Lake and Reservoir Management 13(1):1-12, 1997. This paper concludes that motor boat traffic does reduce plant biomass primarily through direct cutting and scouring of sediments.

(From The Effects of Motorized Watercraft on Aquatic Ecosystems) Yousef and others (1980) is the most often cited publication on motor boat impacts. Turbidity, phosphorus, and chlorophyll a (chl a) were measured on control and intentionally mixed sites on three shallow Florida lakes (all less than 6 m or 18 ft deep), both before and after a set level of motor boat activity. On the two shallowest lakes, significant increases were seen in these parameters on the mixed sites, but not at the control sites. Average increases in phosphorus ranged from 28 to 55%. Maximum increases in turbidity and phosphorus occurred within the first two hours of boating activity. Turbidity declined at a slower rate after boating ceased, taking more than 24 hours to return to initial levels.

Conclusions:

Boats have been shown to affect water clarity and can be a source of nutrients and algal growth in aquatic ecosystems. Shallow lakes, shallow parts of lakes and rivers, and channels connecting lakes are the most susceptible to impacts. Depth of impact varies depending upon many factors including boat size, engine size, speed, and substrate type. Few impacts have been noted at depths greater than 10 feet, however there are high impacts at depths less than 3 feet. Less certain is the overall impact boats have on water clarity compared to other factors such as shoreline development, watershed runoff, storm events, and natural food web cycles. The cumulative impacts of boats on water clarity are also uncertain, as is the link between increased sediment re-suspension and algal growth. Translating effects observed under experimental conditions to what happens under actual conditions can be difficult.

Several researchers have documented a negative relationship between boat traffic and submerged aquatic plant biomass in a variety of situations. The primary mechanism appears to be direct cutting of plants, as many have noted floating plants in the water following



heavy boat use. Other researchers have determined that scouring of the sediment, uprooting of plants, and increased wave activity may also be factors. Where frequent boat use has created channels or tracks, it was noted that these scoured areas persist for several years. While boats can uproot plants and reduce growth, it is still unclear what the long-term effects of boat traffic are on the macrophyte community, especially in lakes. Most studies that noted decreased plant growth in high boat traffic areas were in rivers where boat traffic is more confined and waves may be more of a factor. Also unknown is the effect on macrophyte species composition and the subsequent effect on other components of the aquatic ecosystem, such as the fish community and water quality. As one study noted, the amount of plant material chopped up by boats was a very small proportion of the whole plant community. It is unclear if such a small amount of plant material lost has larger-scale or longer-term impacts. Basing no-wake and no-motor zones on water depth or the maximum depth of plant growth may be more useful than those based upon fixed distances from shore.

One time versus repeated behavior: This would be a repeated behavior because each time a boater came to the lake he would have to choose not to use his motor.

Serious External barriers to target population: If a boater was unable to power her boat by any other means than motor (e.g. she had no arms) she would be unable to access sensitive habitat areas and boat in those areas. This might be viewed very seriously given Wisconsin's emphasis on public access for natural resources.

Opportunities for array of CBSM tools: There are some opportunities, however, given that a portion, possibly a large portion, of the target population may only be accessible to us when using the lake it may prove difficult to target the entire population with an array of tools. However, depending on how tightly knit the lake community is there may be a chance to create norms, especially if we are able to enlist a charismatic individual who is part of the community.

Incentive Potential: There is no ability to use cost-sharing as we have been for other behaviors, but there will be money saved from less fuel use. Non-motor users could be viewed as good citizens.

Other Considerations: Unless someone is actively watching this would be a difficult activity to monitor because the benefits are uncertain.

Sources: Timothy R. Asplund, "The Effects of Motorized Watercraft on Aquatic Ecosystems," Wisconsin Department of Natural Resources: Bureau of Integrated Science Services and University of Wisconsin - Madison, Water Chemistry Program March 17, 2000 PUBL-SS-948-00

(Footnotes)

- 1 <http://www.lakeripley1.homestead.com/lakefacts.html>
- 2 <http://www.plantmichigan.com/documents/PhosphorusforHomes.pdf>
- 3 <http://www.mnaction.org/showalert.asp?aaid=238>



Appendix B

Cover Letter:

Dear {Mail Merge Field with landowner name},

The Lake Ripley Management District is currently assessing a possible rain garden program in the Lake Ripley area. You have been contacted because you are a member of the Lake Ripley Management District. As a resident of the Lake Ripley area we are interested in your perceptions of rain gardens. To gauge the perception of rain gardens in the area we have enclosed a questionnaire with this letter.

The Lake Ripley Management District (LRMD) was formed in 1990 under the authority of Chapter 33 of the Wisconsin Statutes. Its purpose is to help ensure the protection and effective management of Lake Ripley. The LRMD is a local, special-purpose unit of government that serves approximately 2,000 property owners in the Lake Ripley area. LRMD boundaries closely follow those of the Oakland Sanitary District.

Please take a few moments to complete this survey and return it to the Management District. We have enclosed a return envelope for your convenience. Your input from this questionnaire will greatly help the Lake Ripley Management District.

Thank you again for your time and input,

Paul Dearlove, Lake Manager
Oakland Town Hall
N4450 CTH A
Cambridge, WI 53523
(608) 423-4537
ripley@charterinternet.com



Lake Ripley Management District Rain Garden Questionnaire

Please take some time to fill out our questionnaire. The main goal of this questionnaire is to provide the Lake Ripley Management District with data on the perceptions about rain gardens of the population in the area surrounding Lake Ripley. Your answers on this questionnaire will be used by the Management District to evaluate the use of rain gardens in the Lake Ripley area.



Rain garden in a typical residential setting (image from recovered from <http://www.urbanwaterquality.org/RainGardens/LIDRG1.jpg>).

Rain gardens are planted depressions that occur naturally or are created, and are designed to receive all or part of excess rain water or melted snow from a developed area. Through a combination of plant type and garden design, rain gardens have the capacity to promote absorption of water into the soil within a concentrated area, which prevents the water from ponding in low lying areas or eroding the land surface on its way to storm drains or surface water bodies. Rain gardens are one method to provide a means of trapping and filtering pollutants from excess water runoff from a property instead of allowing the water to flow directly into storm sewers, other surface bodies of water or low areas.



1. I will to install a rain garden on my property during this growing season.
extremely unlikely :____:____:____:____:____:____: extremely likely
2. For me installing a rain garden on my property in the next growing season would be:
difficult :____:____:____:____:____:____: easy
not enjoyable :____:____:____:____:____:____: enjoyable
bad for Lake Ripley :____:____:____:____:____:____: good for Lake Ripley
3. My neighbors
disapprove :____:____:____:____:____:____: approve
of my installing a rain garden on my property in the next growing season.
4. What my neighbors think is
not important :____:____:____:____:____:____: important
to me.
5. The Lake Ripley Management District
disapproves :____:____:____:____:____:____: approves
of my installing a rain garden on my property in the next growing season.
6. What the Lake Ripley Management District thinks is
not important :____:____:____:____:____:____: important
to me.
7. My family
disapproves :____:____:____:____:____:____: approves
of my installing a rain garden on my property in the next growing season.
8. What my family thinks is
not important :____:____:____:____:____:____: important
to me.
9. The University Wisconsin Extension
disapproves :____:____:____:____:____:____: approves
of my installing a rain garden on my property in the next growing season.
10. What the University of Wisconsin Extension thinks is
not important :____:____:____:____:____:____: important
to me.
11. Many people like me have a rain garden on their property.
extremely unlikely :____:____:____:____:____:____: extremely likely
12. If I wanted to I could install a rain garden on my property during the next growing season
definitely false :____:____:____:____:____:____: definitely true



13. Why would you be able to / not be able to install a rain garden during the next growing season?

14. What else do you associate with your installing a rain garden on your property in the next growing season?

15. If I installed a rain garden on my property in the next growing season my property value would increase.

extremely unlikely :____:____:____:____:____:____: extremely likely

16. Increasing my property value is

not important to me :____:____:____:____:____:____: very important to me

17. If I installed a rain garden on my property in the next growing season it would decrease the likelihood of my having to drill a new well in the future.

extremely unlikely :____:____:____:____:____:____: extremely likely

18. Not having to drill a new well in the future is

extremely bad :____:____:____:____:____:____: extremely good

19. If I installed a rain garden on my property in the next growing season it would increase the water quality of Lake Ripley.

extremely unlikely :____:____:____:____:____:____: extremely likely

20. Increasing the water quality of Lake Ripley is

extremely bad :____:____:____:____:____:____: extremely good

21. If I installed a rain garden on my property in the next growing season it would increase the wildlife habitat in my yard

extremely unlikely :____:____:____:____:____:____: extremely likely

22. Increasing the wildlife habitat in my yard would be

extremely bad :____:____:____:____:____:____: extremely good

23. What is the single most important thing that would convince you to install a rain garden on your property during the next growing season?

24. What is the single most important thing that would convince you to not install a rain garden on your property in the next growing season?

25. Are there any other issues that come to mind when you think about the difficulty of installing a rain garden on your property in the next growing season?

26. There are _____ adults (19 years old and above) and _____ children (18 years old or below) living in my household. I am an adult / child in my household.

27. I am a seasonal / year round resident of the Lake Ripley area.

28. I live _____ miles from Lake Ripley.

29. When I describe where I live I identify with Lake Ripley / Cambridge / Oakland / Other.

If you chose other please specify. _____

Appendix C

TYPES OF RAIN GARDENS

Butterfly & Friends Garden



Attracts Butterflies and Birds

The plants in this garden are attractive to butterflies and birds. The plants are hardy and adapted to our area. This garden is for sunny areas—places receiving more than six hours of direct sunlight per day.

DayLily Garden



Lowest Maintenance

This garden is for sunny areas—places receiving more than six hours of direct sunlight per day. In shady locations these plants will have few blooms.

Easy Shrub Garden



Lowest Maintenance

This garden is for sunny or partly-shaded areas—places receiving more than three to four hours of direct sunlight per day. In shady locations these plants will have fewer blooms.



Prairie Garden



Native Flowers and Grasses

The plants in this garden are all native to Minnesota prairies. The plants are hardy and adapted to our area. This garden is for sunny areas—places receiving more than six hours of direct sunlight per day.

Shady Garden



Cool Colors

This garden is for shady or partly shaded areas—places receiving less than six hours of direct sunlight per day.

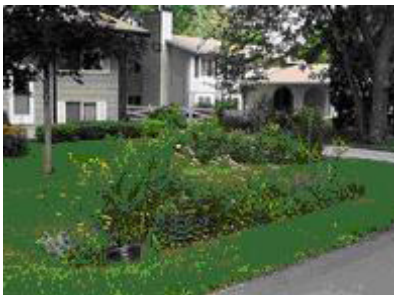
Sunny Border Garden



Cool Colors

This garden is for sunny areas—places receiving more than six hours of direct sunlight per day. In shady locations these plants will have few blooms.

Sunny Garden



Warm Colors

This garden is for sunny areas—places receiving more than six hours of direct sunlight per day. In shady locations these plants will have few blooms



Appendix D

RAIN GARDEN COMMITMENT FORM



Lake Ripley Management District
 Oakland Town Hall
 N4450 CTH A
 Cambridge, WI
 53523

In the interest of improving water quality in the Lake Ripley Management District, I _____
Full Name
 here by commit to installing a rain garden on my property by _____. I will use the guidelines
Date
 outlined by the Lake Ripley Management District to design my rain garden, as they apply to the characteristics of my property. I here by also commit my household to maintaining my rain garden as a functioning rain garden for the duration of my residency at this location:

 Full Address of the Property

 Date

 Signature

It is okay ___ / not okay ___ to print my name in community newsletters stating that I have committed to installing and maintaining a rain garden on my property.

Lake Ripley Management District
 Paul Dearlove, Lake Manager
 (608)423-4537
 ripleym@charterinternet.com



Appendix E

Appendix E: Ideas for Signs/Stickers

