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WATERSHED-BASED REGULATION AND A PROPOSED
STORM WATER RETROFIT IN MID-MICHIGAN

presented by

MARISA A. RINKUS

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M.S. degree in Fisheries and Wildlife

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RETHINKING URBAN STORM WATER MANAGEMENT: IDENTIFYING STAKEHOLDER ATTITUDES TOWARD WATERSHED-BASED REGULATION AND A PROPOSED STORM WATER RETROFIT IN MID-MICHIGAN

By

Marisa A. Rinkus

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ABSTRACT

RETHINKING URBAN STORM WATER MANAGEMENT: IDENTIFYING STAKEHOLDER ATTITUDES TOWARD WATERSHED-BASED REGULATION AND A PROPOSED STORM WATER RETROFIT IN MID-MICHIGAN

By

Marisa A. Rinkus

This research explores watershed-based storm water regulation and a proposed structural best management practice (BMP) in an urban commercial area of Lansing, Michigan, by deconstructing the knowledge, attitudes, and practices of key stakeholders. Using a mixed-methods approach, semi-structured interviews (N = 27) with jurisdictional stakeholders and a researcher administered questionnaire (N = 370) sampling four primary user groups (residents, recreational users, shoppers, and businesses) within the drainage basin of the proposed BMP were conducted. Results indicate that watershed-based regulation has increased awareness of storm water issues among municipal actors and fostered multi-jurisdictional collaboration. Respondents exhibited strong support for innovative BMPs, such as rain gardens and constructed wetlands, for their aesthetic and environmental benefits, however financial responsibility was still of concern. Perceived barriers to such practices included cost, construction time, maintenance, lack of standardization in application, and uncertainty of water quality benefits. These findings have implications for municipalities seeking to build support for storm water BMPs and adapting the watershed approach to regulate storm water in urbanized areas.

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Dedicated to my grandparents,
Doris Rinkus and in loving memory of Walter Rinkus,
Leo and Ann Ciaramitaro

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LIST OF ABBREVIATIONS

BMP	Best Management Practice
CWA	Clean Water Act
EPA	Environmental Protection Agency
GLRC	Greater Lansing Regional Committee for Stormwater Management
IRB	Institutional Review Board
LID	Low Impact Development
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
MSU	Michigan State University
NPDES	National Pollutant Discharge Elimination System
NGO	Non-Governmental Organization
NPS	Non-Point Source
PEP	Public Education Plan
SWPPI	Storm Water Pollution Prevention Initiative

Chapter 1

Introduction

The evolution of storm water management from a focus on water quantity to water quality over the past 30 years presents challenges to the creation, implementation, and regulation of storm water management efforts in urbanized areas. Scientific evidence has confirmed the detrimental effect of impervious surfaces on local water bodies and the resulting impacts on human health and aquatic species. In spite of this, new technologies such as rain gardens and constructed wetlands used to reduce pollution from storm water runoff are rare in most U.S. cities. Similarly, public awareness of storm water impacts is lacking even where water quality is perceived as poor. While water resource experts may not have come to a consensus on the right tactics for reducing storm water pollution, non-point source (NPS) regulation is forcing local municipalities to decide.

Amendments to the Clean Water Act (CWA) in 1987 charged the Environmental Protection Agency (EPA) to regulate storm water that reaches municipal storm sewer systems (MS4s) as sources of NPS pollution (U.S. Governmental Accountability Office [GAO], 2007). As a result, NPS pollution has become a higher priority for municipalities creating a need for increased awareness of storm water management strategies and technologies. Although point source pollution has been significantly reduced in urban rivers nationwide owing to the CWA, the multi-jurisdictional and multi-faceted nature of NPS pollution from storm water runoff is more difficult to regulate. Non-point source pollution, like most natural resource issues, defies the traditional command and control approach to environmental regulation, which "assumes that the problem is well-bounded,

clearly defined, relatively simple, and generally linear with respect to cause and effect" (Holling & Meffe, 1996). In an effort to address this, the State of Michigan has piloted a watershed-based permit focused on developing watershed plans and cooperative partnerships to address pollution prevention and mandated requirements in a more holistic and flexible manner.

Similar command and control philosophies have also directed the technological side of storm water management, which has historically relied on manufactured engineering devices to control hydrology, often solving one problem while creating another (Debo & Reese, 1995; Reese, 2001). The current storm water philosophy aims to recreate or maintain the natural hydrology while reducing pollution. With the application of a watershed approach to storm water, municipalities are rethinking storm water management to incorporate innovative practices, both structural and non-structural. In Michigan, cities including Grand Rapids, Grayling, Lansing, Green Oaks Township, and Ann Arbor have implemented a variety of practices, from ordinances that promote low impact development (LID), reducing the amount of impervious surfaces created, to the creation of filtration systems such as rain gardens, constructed wetlands, or green roofs that retain and filter water onsite (Dempsey, 2006). This new approach also requires stakeholder involvement in planning and implementation, something that has not traditionally been characteristic of urban storm water management.

This research identifies the attitudes of stakeholders in the Mid-Michigan area regarding urban storm water regulation and best management practices (BMPs) by understanding the knowledge, perception, and practices of various stakeholder groups on both macro and micro levels. On the macro level, I examine the challenges and benefits

to the current cooperative approach to storm water regulation, as well as implementing structural BMPs such as rain gardens and constructed wetlands. These issues are then considered on a micro level in the case of a proposed storm water retrofit in the Lansing area. I will begin by presenting contextual information regarding the link between NPS pollution and urbanization, the use of BMPs in pollution prevention, and the regulatory aspects of storm water management. Following this, I will explain the specific objectives and questions that directed the research. Finally, I describe the study area where the data were collected before beginning a discussion of the research methodology, data collection and analysis in Chapter 2.

Background

Non-Point Source Pollution and Urbanization

The historical beginnings of many cities depended on waterways such as rivers, lakes, streams, and bays for transporting goods and services, in addition to providing fresh water for local consumption and food preparation. However, population growth and industrialization have resulted in rapid worldwide urbanization and the subsequent environmental degradation of the natural systems once responsible for the successful rise of civilization. Urban expansion and the resulting increase in impervious surfaces have transformed aquatic systems dramatically. A nationwide survey of wadeable streams conducted by the EPA in 2004 and 2005 found that 42% of the country's stream length is in poor condition, with the main stressors identified as nitrogen, phosphorous, riparian disturbance, and streambed sediments–all aspects of non-point source pollution (U.S.

Environmental Protection Agency [EPA], 2006a). Currently, more than 75% of the U.S. population resides in urban areas with 65% of the total impervious surface cover consisting of roads, parking lots, rooftops, and driveways (Center for Watershed Protection [CWP] website, n.d.).

Impervious surfaces alter the natural flow of waterways by not allowing rainwater to naturally infiltrate back into the aquifer, creating storm water, which can lead to flooding, a reduction in groundwater, and increased turbidity in streams. Due to the inverse relationship between impervious surface area and water quality, a highly urbanized area can produce 50% more runoff than a natural landscape (depending on slope, soil, and vegetation type). Paved surfaces are also generally heat-absorbing and can increase rainwater temperature by 10 degrees Fahrenheit, which when added to local water bodies can decrease oxygen thereby threatening fish and other aquatic life (Frazer, 2005).

Research has shown that the amount of impervious surface within an area can be an indicator of stream quality, with thresholds of 10–30% surface cover before water quality, aquatic habitat, and human health are negatively affected (Wang, Lyons, Kanehl, & Bannerman, 2001). During and after a wet weather event, toxic substances, including pesticides, nutrients (phosphorous and nitrogen), oil and grease, human and animal refuse, and pathogenic organisms, are washed into storm drains and discharged untreated into local waterways (Wang, et al., 2001; Frazer, 2005; Paul & Meyer, 2001). This assault on water quality presents significant risks to the health of the aquatic organisms often concomitant to human health threats. Water-borne diseases that can be transmitted to humans via fish consumption, recreational skin contact, ingestion of contaminated

water, or inhalation are becoming more common with the proliferation of urbanization (Frazer, 2005). These and other effects—such as stream bank erosion, widening of the stream, shallow water in dry weather, and swift deep water in wet weather can reduce biodiversity, aesthetic value, and subsequently recreational value.

Best Management Practices for Pollution Prevention

Traditional storm water management has been dominated by technical engineering practices designed primarily to mitigate flooding, often without fully taking into account the effects on water quality and aquatic habitat. In order to manage both water quality and quantity, a variety of techniques, measures, and structural controls termed storm water best management practices (BMPs) have been developed. Two categories exist: nonstructural or source control BMPs and structural or treatment BMPs (EPA, 2006b).

Nonstructural BMPs do not require extensive construction or permanent fixtures and generally involve institutional measures, such as governmental regulation (e.g., zoning ordinances and planning), educational programs, and economic instruments, to prevent or minimize storm water pollution runoff. Structural BMPs address water quantity, water quality, or both through engineered systems designed to temporarily control runoff and remove pollutants (EPA, 2006b; Debo & Reese, 1995). These structural BMPs can be installed underground or within the landscape, as is the case with rain gardens (Figure 1.1), bioretention ponds, and constructed wetlands.

A rain garden is typically a shallow depression consisting of native plants or grasses with long root systems making them hearty enough to withstand harsh conditions

(Department of Environmental Resources Planning and Programs Division, n.d.; Southeastern Oakland County Water Authority, n.d.). Depending on the quantity of water the rain garden needs to handle, the depression can vary from eight inches to two feet in depth.[1] Residential developments in particular have been replacing traditional curbs and gutters; instead incorporating rain gardens that capture water from sidewalks, driveways, and residential streets. Although such projects can involve advanced engineering designs to filter water before it enters the storm drain, smaller-scale rain gardens can also be built into the landscaping of a typical suburban yard to reduce flooding in low-lying areas. Rain gardens are valued for their abilities to reduce pollution and flooding while simultaneously providing an aesthetic benefit (Dempsey, 2006).

Figure 1.1 – Rain garden on Michigan Avenue, Lansing, Michigan

[1] Information regarding rain garden design and installation varies depending on the application. They are also sometimes referred to as bioretention ponds. More information regarding residential application can be found at http://www.raingardennetwork.com/ or http://www.raingardens.org/Index.php.

Similarly, constructed wetlands are built to emulate natural wetlands by filtering pollutants and buffering storm water peak flows. The application of constructed wetlands has been more common in golf courses, on or near agricultural lands that were once drained, and in urban or suburban residential parks. Both practices can have multiple benefits outside of improvements to water quality, such as providing recreational opportunities in urban areas, increasing wildlife habitat, improving a recreational activity in the case of golf courses, increasing property values for homeowners, and providing green space in highly urbanized areas (Campbell & Ogden, 1999).

The emergence of these *natural* storm water management practices in the 1990s has helped raise awareness of storm water runoff and the importance of mitigating NPS pollution. However, these alternatives are still far from becoming mainstream, particularly in older urban areas where the cost and construction involved in retrofitting an existing area can be major deterrents to local municipalities, property owners, taxpayers, and the general public. Analogous to the assumption that storm water runoff from small construction sites is too small to have a significant effect on the watershed; some believe that the benefits of rain gardens or other BMPs are too small to improve water quality in local streams. However, just as the cumulative negative effects have shown, an increase in the use of such practices throughout the watershed could provide pollution prevention with short- and long-term benefits.

Phase II and Storm Water Management in Michigan

In 1990, Phase I of the EPA's storm water program was promulgated under the CWA through the National Pollutant Discharge Elimination System (NPDES) permit

coverage to address polluted runoff. This rule specifically targeted municipal separate MS4s with populations greater than 100,000, construction sites of greater than 5 acres, and 10 categories of industrial activity (EPA, 2005). Phase II, which began officially in 2003 prior to a voluntary permit period of 4-years, further augmented the program by including MS4s with populations less than 100,000 and construction activities of less than 5 acres (EPA, 2005). The state of Michigan petitioned the EPA for the option of a watershed-based permit at the request of the Rouge River Watershed Council as an alternative to individual jurisdictional permits (D. Drullinger, personal communication). The concept behind the watershed permit is to allow municipalities the flexibility to choose the BMPs most suited to their situation, while providing opportunities to share financial and administrative burdens.

The watershed permit requires local governmental units within a watershed to conduct watershed planning and management collectively in order to meet the permit's Six Minimum Measures (Michigan Department of Environmental Quality [MDEQ], 2003):

1. Public education and outreach on storm water impacts;
2. Public involvement/participation;
3. Illicit discharge detection and elimination;
4. Construction site storm water runoff control;
5. Post-construction storm water management in new development and redevelopment; and
6. Pollution prevention/good housekeeping for municipal operations.

The first two components of the permit, public education and participation, are to be targeted at the community level, including businesses, landowners, schools, the media,

industry, and community groups. Topics for educational efforts can include car, lawn and pet care, household hazardous waste disposal, septic systems, and downspout connections. The ultimate goal of these measures is to increase awareness and build public support that will eventually lead to individual behavior change. In addressing post-construction storm water management in new development and redevelopment, municipalities must devise a plan for implementing and maintaining structural and non-structural BMPs.

Non-structural BMPs involve incorporating LID ideas into zoning, planning and building codes. For urban storm water management, LID offers ways to integrate storm water controls throughout the landscape instead of relying on end-of-pipe (ponds) or in-the-pipe (catch basin filters) structural methods. Structural BMPs include rain gardens, bioretention ponds, constructed wetlands, grassy swales, porous pavement, and other manufactured filtration devices (Debo & Reese, 1995; CWP website, n.d.). Pollution prevention and good housekeeping for municipal operations target the municipalities themselves to ensure that they are evaluating how employees handle and dispose of hazardous waste, maintain catch basins, identify illicit discharges, and manage soil erosion on municipal construction sites.

In the mid-Michigan area, the Greater Lansing Regional Committee for Stormwater Management (GLRC) was established under the watershed permit to coordinate the creation of watershed management plans for three area rivers that form part of the Lake Michigan Watershed: the Grand, the Looking Glass, and the Red Cedar Rivers. The GLRC is comprised of 18 municipal government representatives, in addition to county and state government agency advisory members. GLRC members must submit

a Storm Water Pollution Prevention Initiative (SWPPI) explaining how they will evaluate and execute the action items proposed in the watershed plan within their jurisdiction and yearly progress reports (EPA, 2003). The permit is reissued every 5-years, with the first cycle ending April 2008 and the second beginning May 2008 (MDEQ website, n.d.).

Research Purpose and Objectives

In 2007 the Ingham County Drain Commissioner expressed interest in retrofitting a commercial shopping center parking lot and municipal golf course with rain gardens and constructed wetlands as a means of reducing water pollution and improving the aesthetics of the two areas. Before a formal proposal can be brought before decision makers, the social (public attitudes, concerns, perceptions) and biological (hydrology, water quality, fish and aquatic habitat health) aspects need to be assessed. The purpose of this research is to understand the attitudes of various stakeholders related to storm water regulation and BMPs in a highly urbanized area. The main objectives of the study are:

1. to identify institutional and individual social actors involved in storm water and watershed management, and the barriers and incentives they perceive in meeting local, state and federal regulations; and

2. to understand the knowledge, attitudes, and practices of various stakeholders regarding storm water management, pollution prevention, and water quality within the study area.

In order to meet these objectives I explored the following questions:

- What are the perceived barriers and incentives to implementing natural storm water BMPs, such as rain gardens and constructed wetlands, across stakeholder groups?
- How has Phase II and Michigan's watershed-based permit affected attitudes toward storm water management and natural storm water BMPs?
- What are the current perceptions of or attitudes toward the study area and how might they affect support for the construction of a BMP (e.g., aesthetics, water quality, use or purpose of area, knowledge of BMPs)?
- What concerns do stakeholders have about such a project and how can these concerns be addressed?

While surveys have been conducted by local agencies and organizations to assess public knowledge to influence individual behavior change (Rouge River Wet Weather Demonstration Project, 1999; Greater Lansing Regional Committee for Stormwater Management [GLRC], 2006), understanding how various stakeholders' attitudes and perceptions influence decision making and adoption of innovative technologies is valuable for successful communication and implementation of storm water projects. Similarly, the application of rain gardens and other natural storm water technologies has been primarily relegated to residential areas or new commercial development. Because of limited human dimensions-related research regarding storm water management, this project presents a unique opportunity to explore stakeholder attitudes and perceptions of toward storm water management concerns and technologies. Furthermore, the Drain

Commissioner's proposal to retrofit, or reconstruct, a large commercial area in a highly visible urban setting represents the first of its kind in the nation (P. Lindemann, personal communication).

Description of Study Area

My study area is situated within a sub-watershed, Red Cedar C (Montgomery Drainage District – Figure 1.2), of the Red Cedar River. The Red Cedar Watershed covers 106,000 acres mainly within Ingham and Livingston Counties located in the central portion of Michigan's Lower Peninsula. The Montgomery Drainage District is home to the Frandor Shopping Center (among many other businesses), the Red Cedar Golf Course, residential homes and apartments, and the Red Cedar River. The area is also at the crossroads of Lansing, East Lansing, and Lansing Township, and is traversed by Interstate 496, US-127, Grand River Road, and Saginaw Highway. In total, 60% of the surface area is impervious (Tetra Tech Inc., 2005).

The Montgomery Drain is a storm drain, or underground pipe, that collects any runoff entering the catch basins within the drainage area. Starting where the drain begins in a residential neighborhood north of Saginaw Highway and following the drain south, it runs under a series of commercial developments and major roadways. Of particular importance in this study is the Frandor Shopping Center, a possible future site of a storm water BMP retrofit project (Figure 1.3). The Frandor Shopping Center, one of the oldest shopping centers in the state, opened in the 1950s, with the original design consisting of enclosed walkways that have since been removed as part of a 1998 renovation. The

shopping center hosts approximately 70 sites for lease, such as retail stores, restaurants, and other small businesses, and serves a diverse community from the surrounding area owing to its location at the junction of Lansing and East Lansing. The most frequented public bus line, the #1, which runs from downtown Lansing to the Meridian Mall, also makes stops within the shopping center's parking lot. In relation to storm water, the Frandor Shopping Center consists of a vast parking lot with a capacity for more than 1000 vehicles, making it an island of impervious surface within the drainage district.

Figure 1.2 – Map of Montgomery Drainage District (outlined in rectangle) and surrounding area

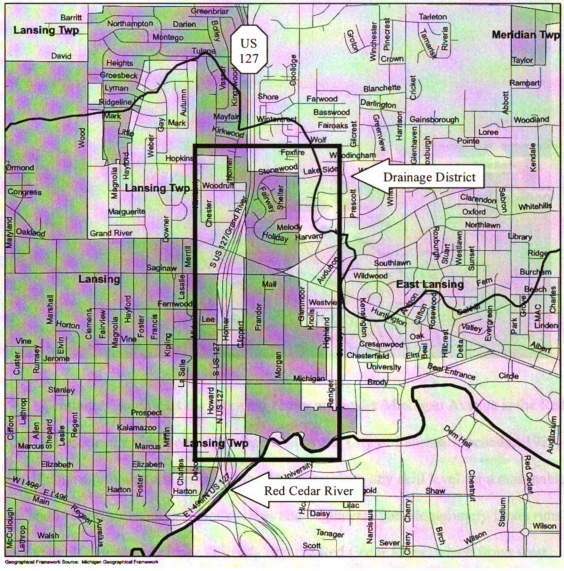


Figure 1.3 – Frandor Shopping Center parking lot

Continuing south past the shopping center and under Michigan Avenue is the Red Cedar Golf Course, a nine-hole course operated by the City of Lansing. Opened in 1925, the golf course provides a short layout that is accessible to any skill level for a reasonable price and is a favorite among senior citizens and beginners. The Montgomery Drain runs under the golf course and empties directly into the Red Cedar River, which flows west along the south side of the course and the Kircher Municipal Field baseball diamonds before crossing under Kalamazoo Street. Because the golf course is in a floodplain, it is prone to frequent flooding, much of which is a result of storm water backing up in the drain. In addition to the storm water outfall, the East Lansing Wastewater Treatment Plant releases effluent into the river just south of the Kalamazoo Street bridge.

The Lansing River Trail is a non-motorized trail running approximately eight miles along the Grand and Red Cedar Rivers (Figure 1.4). The asphalt surfaces and boardwalks support a wide variety of recreational activities, including biking, walking, rollerblading, and running. Connecting MSU and the downtown and northern regions of the City of Lansing, the trail is a popular commuter route. In addition, the river walk, as it is also known, provides wildlife viewing in woodland and wetland settings within an urban landscape. The quarter-mile portion of the trail within my study area is situated at the edge of the MSU campus and US-127, and is also one of the trail access points with a parking lot.

Figure 1.4 – Red Cedar River Walk, part of the Lansing River Trail

The Red Cedar River is a major tributary of the Grand River flowing forty-five miles through a variety of landscapes from agricultural fields to highly urbanized centers (Figure 1.5). The river is best known as a scenic addition to the campus of MSU, which has historically garnered a poor reputation among students because of its murky waters, slow flow, and past sewage contamination. Despite perceptions, students, faculty, and community members frequently use the adjacent paved paths and bridges for recreation or as a means of traveling across campus and spend, hours sitting on its banks socializing or feeding the ducks. Water quality in the Red Cedar has improved over the years due to a reduction in point source pollution, mainly from combined sewer overflows and regular clean-up efforts by volunteer groups.

Figure 1.5 – Red Cedar River

Nevertheless, the Red Cedar River still suffers from past pollution and the continuing effects of storm water runoff. Currently the river is categorized as impaired by the Michigan Department of Environmental Quality for 'Warm Water Fishery,' 'Other Aquatic Life and Wildlife,' and 'Total and Partial Body Contact,' making it unable to meet multiple designated uses (MDEQ website, n.d.). In particular, a recent study has shown that habitat quality in the Red Cedar decreases significantly just before the mouth of the river (near the outfall of the Montgomery Drain) as a result of sedimentation, urban debris, and high flow fluctuations (Tetra Tech Inc., 2005). Water sample data collected by the Ingham County Department of Health for the Red Cedar at Kalamazoo Street exceeded state guidelines for *E. Coli* levels for periods during 2006, at times close to twice the state guidelines (Ingham County Department of Health, n.d.).

The Montgomery Drainage District represents a highly urbanized area within the Mid-Michigan region. Despite this, it offers several recreational opportunities and attracts a diverse population from within and outside of the community as a result of its practical mixed use. Years of heavy use and development in the area have had a negative impact on the aesthetics of both the shopping center and the river, in addition to impacts on water quality, reducing the allure of the area. While the district remains heavily visited and populated, areas for improvement persist. Innovative storm water strategies could enhance the area and remedy issues of aesthetics and water quality.

Chapter 2

Methods

Research Approach and Study Design

Due to the exploratory and descriptive nature of this project in understanding perception and attitudes of stakeholder groups, two types of qualitative interviewing were employed. Semi-structured interviews were chosen for the flexibility they allow within an interview and throughout the progression of the study, as they are easy to adapt as new information is revealed (Rubin & Rubin, 2005). Moreover, I was interested in "understanding the meaning, for participants in the study, of the events, situations, and actions they are involved with," a particular strength of qualitative methods in general and in-depth interviews (Maxwell, 1997). Similarly, a researcher-administered questionnaire was chosen instead of a traditional mail questionnaire in order to more accurately collect and understand respondents' interpretations rather than assume universal understanding of the questions and the issue by respondents.

Using a mix of qualitative methods also assisted me in accessing the various stakeholders in a manner that was appropriate for their level of involvement in storm water management and the proposed BMP. For example, conducting semi-structured interviews with individuals more directly involved in the process allowed me to collect more in-depth information on various aspects of storm water management, while using a researcher-administered questionnaire was useful in targeting a larger number of individuals from the user groups in the study area. This mixed methods approach

provides both breadth and depth of knowledge with the opportunity to triangulate or *check* data against other sources.

In order to discover where commonalities and differences in goals and desires existed among the various stakeholder groups, the following qualitative research methods were utilized: (a) Review of academic and grey literature, meeting reports, government documents, maps, county census information, laws, and policies, as needed; (b) Semi-structured in-depth interviews with stakeholders directly involved with storm water management and the proposed project (i.e., city, county, and state agency staff, municipal officials, engineers, developers, builders, community leaders, and business owners); (c) Researcher-administered questionnaire with stakeholders likely to be affected by the proposed project or with indirect involvement in storm water management (i.e., residents, business managers, shoppers, river and river walk users, and golfers); and (d) Digital photographs of the Red Cedar River and River Walk area, and Frandor Shopping Center to document areas of the drainage district under dry and wet conditions.

The following paragraphs address my primary research methods—semi-structured interviews (N=28) and researcher-administered questionnaires (N=370)—greater detail. Observations, digital photography, and the review of documents were used to check the data collected from the interviews and questionnaires, as well as address threats to validity and reliability discussed later in this chapter.

Data Collection

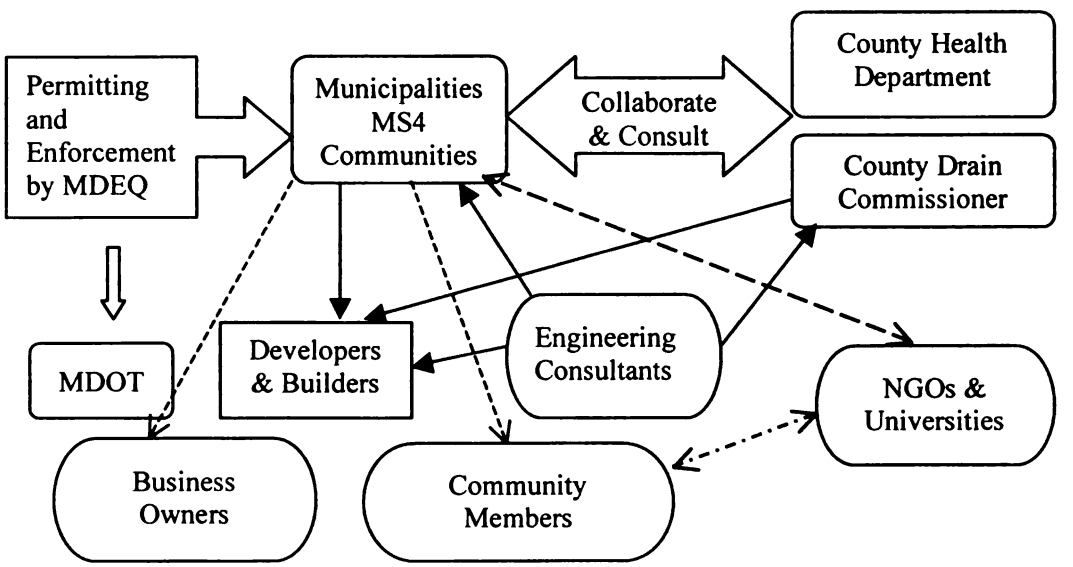
Semi-Structured Interviews

Beginning with a small pilot study, an interview schedule was developed and tested on three individuals representing three different categories of stakeholders—a regulatory agency, municipality, and engineering consultant. The three preliminary interviews enhanced my knowledge (as the interviewer) of the historical and political context, in addition to the technical language used in storm water management (acronyms, permits, etc.). The knowledge gained from these three interviews was used to further refine a standard set of interview questions, along with probing questions specific to each stakeholder group. The structure of the interview guide in semi-structured interviewing assists in maintaining control while still allowing the interviewer or the respondent to probe other areas, which is suitable for interviewing bureaucrats or higher-level members of a community that require efficient use of their time (Bernard, 2005). The finalized schedules consisted primarily of open-ended questions addressing the following themes: (a) attitudes towards storm water regulation and management; (b) knowledge of and attitudes towards alternative storm water management practices; (c) assessment of involvement in the Red Cedar Management Planning process and the GLRC; (d) collaboration in multi-jurisdictional projects; and (e) perceived incentives and barriers to management (see Appendix A for Sample Interview Questions).

In order to acquire a current understanding of storm water management within the Greater Lansing area and the historical context regarding political, regulatory, and technical aspects, a purposive sampling strategy was utilized. Research participants were

chosen based on a stakeholder analysis conducted by reviewing local reports and meeting documents, informal discussion with project partners, and phone conversations with key individuals at MSU who have historically been involved in storm water management projects in the region. The stakeholder categories include community leaders (N=3); private engineers (N=2); government agency employees (N=4); non-governmental organization (NGO) or university affiliates (N=3); developer, builder, or industry representatives (N=3); local appointed or elected officials (N=4); local business owners in the shopping center (N=6); and managers of chain stores in the shopping center (N=3). Figure 2.1 shows the relationship among stakeholder groups in storm water management.

Figure 2.1 – Diagram showing the relationship between stakeholder groups during the storm water management process



Interview contact protocol for other interviewees that were not considered priority or primary stakeholders involved mailing a letter, sending an email within two weeks of the letter, following up with a phone call within another two weeks if still no response, phoning again if a message was left previously, and then a final email or phone call—a total of five attempts. None of the potential respondents contacted declined, but close to half never responded. Because of the large number of businesses in the Frandor area, a simple stratified random sample strategy was used to select interview participants. Sub-groups of businesses were established based on length of time at locale (years) and the characteristic of locally- or nationally- owned (chain). The businesses were then numbered in a list and selected using a random number chart. Interview protocol for business owners involved an in-person attempt, then follow-up in person, and a final attempt by phone. After three attempts without a response (or a decline) the business was removed from the list and the next business on the list, of those randomly selected, was approached. Roughly half of all business owners or managers approached declined.

Interviewing continued until the major stakeholders identified in each group were interviewed or until saturation, which is the point at which no new information is being retrieved through the interview process (Bernard, 2005). All interviews (N=28) occurred between July and December 2007, were conducted in person, and were digitally recorded.[2] The interviews lasted, on average, no more than 60 minutes. However, the longest interview lasted 1 hour and 45 minutes, while the shortest lasted 20 minutes. All of the participants were presented with a consent form at the start of the interview, or in advance if requested, allowing them to elect the level of confidentiality they felt most

[2] Two interviews were not recorded due to technical difficulties and two interviews were conducted by phone. None of the interviews conducted with local businesses were recorded at the request of the interviewees. The researcher conducted all interviews.

comfortable with. Their signature on the consent form acknowledges that they understand their rights as a research participant and my responsibilities as a researcher. The data collected were stored on password-protected computers and locked file cabinets; as noted in the Institutional Review Board (IRB) application only the Principal Investigator and I had complete access to the data during the course of the study.

Questionnaires

Researcher-administered questionnaires were used to document and understand the knowledge, attitudes, and practices of the various user groups within the study area (shoppers, residents, and recreational users, such as golfers and river walk users) regarding storm water runoff issues (water quantity and flooding) and the potential construction of a BMP (rain garden or constructed wetland) to address such concerns. Using this approach, I was able to gather information that could be qualitatively and quantitatively analyzed, providing descriptive statistics for a broad overview of the situation as well as more detailed data for later in-depth exploration of recurrent themes. I began by testing a preliminary set of questions within the study area (N=15) and used this information, along with suggestions from other project team members, to devise the final questionnaire. This small pilot study resulted in better phrasing of questions in order to obtain the information desired while being careful as to not lead the respondent toward any particular answer.

The outcome was a structured questionnaire comprised of open-ended and fixed-choice questions divided into five sections, with a section targeting each of the three

major use areas,[3] a section addressing the proposed change for the area, and a final section for collecting demographic information.[4] Each questionnaire was individually administered face-to-face in an interview lasting five to seven minutes on average. The questionnaire addressed the following themes: (a) practices or use of areas, (b) knowledge of drainage issues, (c) current attitudes towards common use areas in the drainage basin, (d) perception of water quality, (e) knowledge of alternative storm water BMPs (rain gardens and constructed wetlands), (f) willingness to support changes to infrastructure that would improve water quality and aesthetics, (g) support for rain gardens or constructed wetlands, and (h) attitudes towards financial responsibility (see Appendix B for questionnaire). Demographics and personal characteristics such as gender,[5] occupation, age, and city of residence were also collected in order to analyze their possible influence on responses.

In order to capture the knowledge, attitudes, and practices of the four user groups, the interviews were conducted in the four major use areas of the study area: the golf course (N=67), shopping center (N=124), river walk (N=61), and residential neighborhoods (N=118). With the help of volunteers, 370 interviews were completed between late June and early October 2007.[6] For the golf course, shopping center, and river walk, interviews were conducted two to four days per week (weather permitting)

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[3] Red Cedar River Walk, Red Cedar Golf Course and Frandor Shopping Center

[4] At the request of the Drain Commissioner (a project partner) interviews conducted in the residential areas also included questions regarding fertilizer use, composting, and number and type of pet since this information is useful in understanding what might be entering the storm drains through runoff. The results of these data are not included in this study.

[5] Gender is used here since respondents were not asked their sex, leaving it up to the interviewer to decide if the respondent was male or female based on socially constructed ideals of masculinity and femininity.

[6] Volunteers received one half-hour training to familiarize them with the script, questionnaire and general protocols. Those who volunteered more than once received follow-up training based on their previous performance, targeting areas for improvement and reiterating important factors.

during two- to four-hour time blocks each day. Days and times were selected to represent the various uses of the study area, with each day of week and time slot being covered at least once for each location. For example, a representative sample of days and times within the hours of operation of the shopping center businesses (Monday through Sunday 10am–9pm) was selected. Similarly, river walk and golf course interview days and times corresponded to regular hours of use (dawn until dusk Monday through Sunday). Interviewer locations were selected based on designated pedestrian traffic areas (i.e., sidewalks, river walk parking lot, golf course clubhouse area, etc.), however locations within the shopping center were limited to stores that granted us permission to solicit interview participants near their storefront. Passers-by in the above locations were approached by the interviewer with a brief explanation of the research project followed by a request to participate. Before being interviewed each participant was confirmed to be eighteen years or older and notified that their participation was voluntary and confidential in conjunction with Michigan State University IRB regulations. Participants were also presented with a one-page consent form outlining the study, their rights as a participant, and contact information in case they had any concerns, along with a two-sided handout concerning storm water and where to find more information.[7]

Because the residential portion of the study area contained a small number of homes (N=80), and apartment buildings that are often difficult to gain access to for door-to-door interviews, the canvass area was expanded to include surrounding neighborhoods. The neighborhood canvass was conducted with the help of volunteers on four separate occasions during two-hour time blocks (one weekend afternoon, one weekday afternoon,

[7] The handout, "Ten Simple Steps to Protect our Watershed" can be found at http://www.mywatersheds.org/publications.asp

and two weekday evenings) between August and October 2007. A greater effort was made to interview residents within the study area due to the direct effect any change to area drainage could have on them either through taxes or drainage issues. House numbers were recorded if a resident was not at home, and the home was revisited on subsequent occasions, with no more than three attempts made to solicit participation. Households were not randomly selected, nor were respondents, with a focus on more comprehensive participation of those owning homes in and around the drainage district. However, based on the varied selection of days and times, I believe it provided the opportunity for a variety of people to be found at home and willing to participate.

Observations and Digital Photographs

Observations made during the interview time blocks were recorded, including weather, changes to the physical surroundings, number of cars in the parking lot, number of recreationists per recreation type observed (biking, walking, running), pedestrian flow, and other general observations.[8] This information was used to assess the use of the areas at various times of day and days of the week, while also trying to assess the overall use of the area compared with the number of respondents to ensure a representative sample. Changes in the physical surroundings (e.g., trash, puddles, low river level) along with information on weather conditions were documented in order to account for confounding factors that may have influenced participants' responses.

Additionally, digital photographs were taken to visually document the structural and natural changes that occur after wet weather events (standing water, flooding, clarity

[8] See Appendix C for observation log sheet.

of water in the river) and throughout each season. These photographs were taken at three-month intervals from March 2007 to April 2008, and primarily represent changes to areas of the river walk and Frandor Shopping Center. The principle behind the photographs is to corroborate or exemplify participant responses regarding flooding, aesthetics, pollution etc.[9]

Reducing Threats to Validity, Reliability, and Researcher Bias

Qualitative research focuses on understanding the perspective of the respondent, or emic view, which requires the researcher to check their analysis and assumptions against those of the respondents (Chung, 2000). In order to reduce bias in the collection, interpretation, and analysis, I have incorporated the ideals of reflexivity and reciprocity throughout all stages of my research. These ideals first begin with recognizing my own attitudes, knowledge, and perceptions related to the research topic and the way in which my background may have influenced these. This requires critical reflection on my assumptions and personal beliefs when analyzing the information collected. Because of this, having multiple perspectives can increase the internal validity of qualitative research findings (Chung, 2000). By using a purposive sampling strategy to recruit research participants for the interviews, I was able to target various perspectives among the stakeholder groups, ensuring that the respondents did not solely represent my beliefs or assumptions. Furthermore, the use of verbatim transcriptions of the interviews—along with detailed notes, document review, and attendance at meetings of research participants

[9] See Appendix D for photographs of study area.

(as well as non-research participants involved in storm water management)—provided data against which my conclusions could be checked (Maxwell, 2005).

Applying a reflexive approach to the interview process necessitates the use of respect, openness, and clear communication with research participants (Reinharz, 1992). The flexibility of semi-structured interviewing was conducive to this approach by allowing me to use probes as an opportunity for both the researcher and participant to clarify or expand on responses (Miles & Huberman, 1994). Similarly, efforts were made to reduce reactivity, or the influence of the researcher on the participant, which can relate to the participant's level of comfort in the interview location, questions, or even the interviewer (Maxwell, 2005). In an effort to reduce reactivity, all of the interviews were held at a location chosen by the research participant at his or her convenience. In many instances, this was at their place of business, the university, or a public place such as a local café. Research participants were treated in a professional manner that respected the individual opinions of the participants without judgment. Interviews were also conducted in a conversational manner that encouraged dialogue between the participant and researcher. All of these aspects potentially fostered a mutual level of comfort, allowing participants to share their perspectives more freely and reducing the chance of their telling me what they think I wanted to hear (Reinharz, 1992).

Simple numerical counts, or "quasi-statistics," of the interview codes within and among the interviews were also used in evaluating the salience of themes and support for subsequent conclusions (Maxwell, 2005). Because I was not asking the respondents to recall information from the distant past, I don't believe that recall bias was a factor in the information collected. However, because I purposefully targeted those currently involved

in storm water management in the Greater Lansing area, some participants did have a longer history of the process to draw on than others. While researchers can never completely remove their influence on research participants or research itself, I feel that employing these strategies to address the threats to validity and acknowledging the effect of the researcher can improve the understanding of research conclusions.

The decision to orally administer the questionnaires was made in order to gain a better understanding of attitudes and perceptions by allowing for clarification and open-ended responses. This technique also addresses the threats to validity and reliability that are common in mail surveys such as respondents answering questions out of order, low response rates from certain populations (low income-education, non-heads of households, non-property owners, illiterate, etc.), and misunderstanding of the questions (Bernard, 2005). While providing clarification of a question during an interview can be viewed as sacrificing reliability, I feel that validity was much more important in this regard (Bernard, 2005). A significant advantage of being able to converse with a respondent, or potential respondent, was the opportunity to recruit respondents who most likely would not have responded to a mail survey on an environmental issue and to more accurately reach the target populations in the study area.

Conducting the interviews in the locations addressed in the questionnaire itself made it possible for respondents to assess their surroundings in the moment, potentially reducing issues of recall bias. However, since questions were asked about all three locations no matter where the questionnaire was administered, this may have only reduced the recall bias, for questions pertaining to that particular area. The time of year the questionnaire was conducted (summer versus spring) and subsequent weather data

may have also affected recall bias since questions about drainage and flooding may not have been at the forefront of people's mind during the dryer weeks of the summer.

Data Management, Analysis, and Summary

Digital recordings of the interviews were transcribed with the help of two volunteer research assistants, with the exception of two interviews that were not recorded due to technical issues. However, in those cases elaborate notes were recorded immediately after the interview and used in lieu of transcripts. Similarly, notes were substituted for transcripts when research participants requested not to be recorded. All interview notes and transcripts were imported to Atlas.ti[10] for coding and analysis. Atlas.ti is data management software that allows the researcher to organize and code data but does not analyze the data for the researcher. A grounded theory approach was used for the preliminary analysis of the interviews starting with *in vivo* or open coding as a means of identifying thematic areas based on participant responses (Bernard, 2005). An important tool in qualitative data analysis, grounded theory utilizes an inductive strategy toward generating theory that systematically creates hypotheses and concepts from the data throughout the research process (Patton, 2002). Following this methodology, further coding consisted of sorting and assigning descriptive and interpretative codes to be analyzed for patterns among stakeholder groups and broader themes. A simple numerical count of occurrences of codes among stakeholder groups and within interviews was also conducted using the query tool and code manager output in Atlas.ti. A list of identified

[10] http://www.atlasti.com/

themes and codes can be found in Appendix E.

The data collected from the researcher-administered questionnaire were first entered into Microsoft Excel in order to capture the full responses to the open-ended questions in detail, as well as additional comments made along with, or in lieu of, the fixed-choice responses. Two volunteers and I entered these data, which were periodically reviewed for accuracy throughout the data entry process. After all the data were entered, I began the process of data cleansing to identify and correct any incomplete, missing, or incorrect entries and standardize the entry format. Invalid questionnaires were also marked for later removal.[11] Open-ended responses were categorized or scaled and given numerical values in preparation for analysis, along with the responses to the fixed-choice questions. Once the data were exported to SPSS[12] from Excel, frequencies were calculated for each question. Because the majority of the data was nominal or categorical, statistical analysis was limited. However, a cross-tabulation table in SPSS was used to compare proportions of respondents between attitude variables and willingness to support the proposed BMP project, as well as demographic factors such as age and gender. A chi-square test for independence was also performed in SPSS to explore the relationship between these categorical variables. A summary of the data collected can be found in Table 2.1 and 2.2. Results from the questionnaire will be discussed in Chapter 4.

[11] Two respondents under the age of 18 were administered questionnaires, which is against the terms of this study's IRB permission. Additionally, seven questionnaires were missing responses for the entire second page of the questionnaire, rendering them incomplete and therefore invalid.
[12] http://www.spss.com/

Table 2.1 – Interview participants by stakeholder group

Interview Participants by Stakeholder Group	N	Female	Male	Description of Stakeholder Group
Community Leaders	3	2	1	Leaders of neighborhood groups or councils or volunteers of local community-based NGOs
Government Agency Employees	4	0	4	Employees of county, city, or state agencies related to health, environment, and recreation
Developers/Builders	3	0	3	Contractors, developers, builders, pavers, or directors of associations that represent these industries
Private Engineers	2	0	2	Engineering firms that are contracted by city governments or private developers to design storm water controls and related infrastructure
NGO/University Affiliates	3	2	1	Non-governmental or academic institutions with local or regional involvement in storm water management
Municipal Officials	4	0	4	Appointed or elected officials of local municipal governments, including public works department directors
Shopping Center Business Owners—Local	6	3	3	Owners of businesses located in the Frandor Shopping Center
Shopping Center Business Managers—Chain	3	2	1	Managers of national or regional chains of stores located in the Frandor Shopping Center
TOTAL	**28**	**9**	**19**	

**Interviews conducted as part of the pilot study are not included in this table. The information from these interviews was also not included in the results, serving only as background information and as a means of testing interview questions.

Table 2.2 – Demographics of questionnaire respondents

Respondents by location of questionnaire administration	**Frandor N = 124**	**Golf Course N = 67**	**River Walk N = 61**	**Residential Canvass N = 118**	**Total N = 370**
%Female	56.3%	25.4%	41%	50.4%	45.4%
% Male	43.8%	74.6%	59%	49.6%	53.2%
Minimum Age	18	18	18	18	18
Maximum Age	72	86	72	82	86
Average Age of Respondent	44	51	41	39	43
Area of Residence	Lansing 49% East Lansing 22%	Lansing 61.2% East Lansing 19.4%	Lansing 41% East Lansing 14.8%	Lansing 96.6% East Lansing 3.4%	Lansing 64.9% East Lansing 14.1%

**% Female and % Male do not equal 100% because of missing gender data for five questionnaires.

Chapter 3

Creating a Storm Water Presence: Regulation, Technology, and Public Awareness

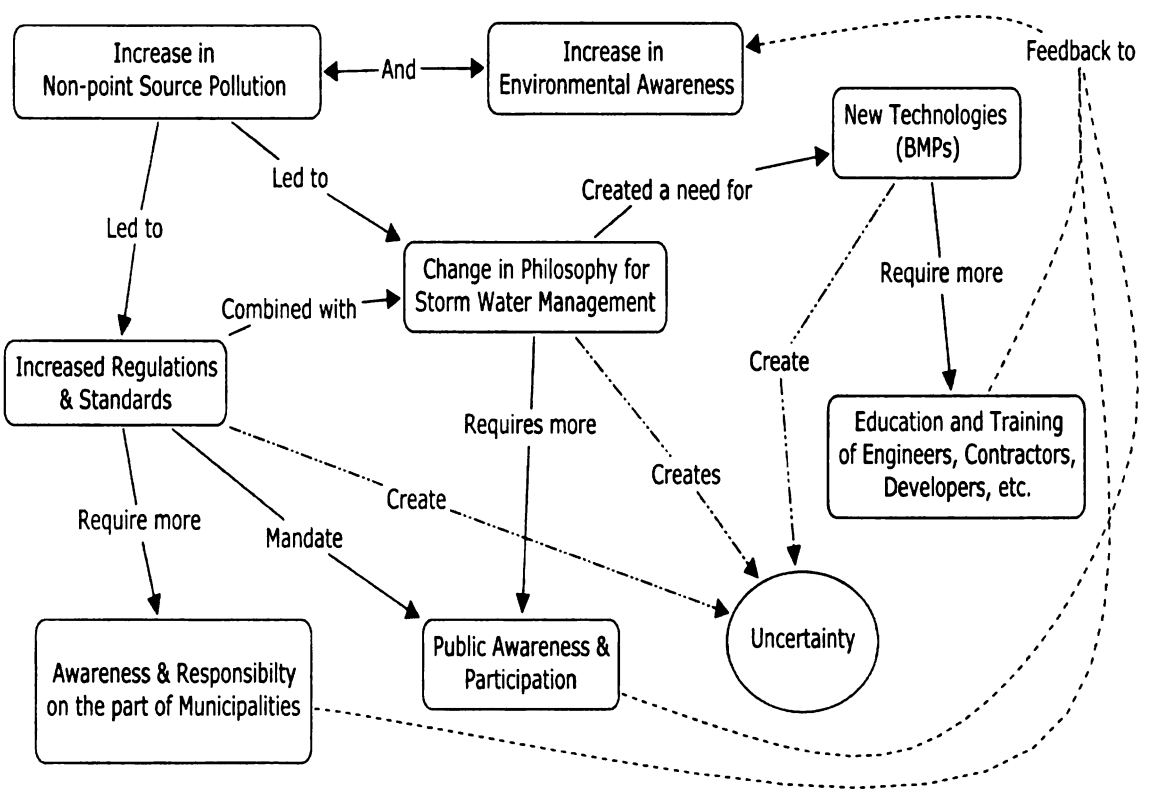
Storm water, once considered a benign substance, has become one of the more destructive adversaries of rivers, lakes, and streams. As scientific evidence confirming the detrimental effects of storm water and public environmental awareness has risen, increased regulation and stricter standards have emerged in response. As expressed by Reese (2001), "knowledge and technology create a real or perceived need for higher, more demanding levels of storm water management and regulation." These combined factors have led to a paradigm shift away from traditional storm water management, focused on storm water quantity issues such as flood protection, toward practices that take into account the effects of storm water quality and quantity on aquatic habitat. In order to address quantity and quality innovative strategies and technologies, both structural and non-structural BMPs have been developed.

While technological interventions are available, broad application remains limited (Brown, 2005), partially due to the uncertainty surrounding design, construction, maintenance, cost, and proclaimed environmental benefits. Non-structural impediments to storm water management (jurisdictional fragmentation, organizational administration, lack of awareness and leadership) are also of concern and well-documented in the literature on cooperative partnerships and collaboration. My findings represent a merging of these concerns in the Phase II watershed-based permit in Michigan, which adds the element of intergovernmental collaboration to regulatory accountability on the part of

municipalities and mandates public education and participation. Current storm water technologies and regulation require greater awareness and participation of all stakeholders in storm water management with the aim of creating a sense of shared responsibility or stewardship.

In this chapter I will present the storm water management discourse as experienced by the stakeholder groups interviewed and identify attitudes toward regulation, technology, and responsibility. Figure 3.1 represents a conceptual framework depicting how I perceive the interaction of these aspects.

Figure 3.1 – Conceptual framework



Change in Storm Water Management Philosophy

Engineers have been at the forefront of surface water management designing storm water systems to meet the changing needs and preferences of a developing nation (Debo & Reese, 1995). Storm water management in the United States has evolved in response to social change that has shifted from "exploration to cultivation to industrialization to urbanization to gentrification" (Reese, 2001). Before urban centers and automobiles gained popularity, storm water management was primarily a facet of agricultural practices, relying on ditches for drainage. Health and aesthetic concerns soon became apparent when this method was applied to urbanized areas, leading to underground piping that sent raw sewage straight to local rivers and streams. This of course only shifted the health concerns to local waterways until sewers and treatment plants were developed. However, it was not considered economically viable to treat storm water, so pipes were constructed to facilitate the suburban storm water paradigm of curbs and gutters that continued to send storm water directly to local bodies of water.

In the early 1970s, storm water detention was seen as the solution to flooding concerns and resulted in the construction of detention ponds. However, flooding persisted, and storm water master planning that utilized computer modeling to analyze 'what-if' scenarios emerged. Municipalities were now unable to manage storm water on their own, relying on engineering consultants. Storm water management required more than computer models, acknowledging the need for consensus building, storm water financing, and improved public relations (Reese, 2001). The 1990s brought Phase I of the EPA's storm water program and a return to earlier storm water practices such as ditches,

now referred to as grassy swales, and improved detention ponds or constructed wetlands. The lack of comprehensive monitoring programs for such BMPs was, and still is, considered a problem, but the development of macro-invertebrate indices for stream health has provided at least one approach that incorporates ecological health.

Today in the Mid-Michigan area, storm water is primarily managed with underground pipes, however there has been a shift toward the integration of various structural and non-structural BMPs over the past two decades. Owing to the fact that engineers are primarily responsible for designing storm water management systems for developers (new residential or commercial development) or governments (public works infrastructure or road construction), the changing storm water philosophy was most often mentioned by research participants representing these stakeholder groups.

> "...traditionally the mentality has been get it out of my sight and away as fast and as quick as possible and that's changing. I think you'll see a paradigm shift in the way we approach storm water drainage and everything moves slow but I think the shift will be more the low impact development, smart growth techniques which promote keeping the water onsite and recreating the hydrology that was there before the site developed." (Engineering Consultant – P1)

> "[As] a matter of fact, I was talking to somebody recently—they were talking about retention ponds and so they wanted to know, so what are municipalities doing? I said, well even now the municipalities have to totally rethink, I said rather than putting in a new street and running a storm drain right to the river they, like all the businesses, are going to have to start putting in retention ponds and filtering systems before they can do that. And I know I remember a few years ago I heard of flooding down in Lansing, and we just really haven't had that much rain. But when you stop and think about all that water going into storm pipes and going directly to the river, it can't settle out anywhere, it's no wonder the rivers are going up now. And it doesn't take a rocket scientist to figure out what's wrong here...it doesn't take much to understand that's just not right...and sure the more construction, the more subdivisions that go in...but we're putting more impervious [surface] you know, sidewalks, driveways, rooftops, and all that runoff goes directly to the river, none of it's getting a chance to soak back in and go to ground water. So you...like I said, it doesn't take a real rocket scientist to figure that out." (Municipal Official – P2)

Although the awareness surrounding storm water management has been increasing over the last 30 years, progress has occurred at different rates across various industries and areas of the country. The influence of smart growth on zoning and regional planning efforts has been driving innovation in new development and road construction, which is now also getting more attention at the local level as a result of Phase II regulation. Participants acknowledged the overall trend toward environmental sustainability and increased concern for the environment among citizens as a parallel force with regulation.

> "We're just at a point where there's a general realization that things need to be different and change and we're beginning to see that in fits and starts in the home building industry with green building techniques..." (Developer/Builder – P7)

> "Local governments are all at a different level for what they are doing with storm water management. You know and some are very progressive and have an ordinance. They are protecting their natural features, they are promoting open space subdivisions, and others have really done nothing. " (NGO Affiliate – P6)

Consumer preferences in the housing market, the availability of land for development, and public education were similarly noted as reasons for the shift in industry standards. Over time these standards and regulations can become institutionalized within the industry or government practices. An example that was presented during an interview was that of the EPA's Energy Star rating for energy efficiency in houses and appliances,[13] which over time has educated homebuilders and homeowners on the importance of investing more money at the onset for improved energy efficiency in the future. Because of this program it is rare today to find a new house built that doesn't meet these standards and "over 10, 15, 20 years, eventually

[13] http://www.energystar.gov/

you've created a new standard and most everybody's doing it [and] at the same time you're educating the public" (Developer/Builder – P7). New standards and regulation have contributed to an increase in innovative technologies and strategies for storm water management, referred to as BMPs.

Uncertainty and Innovation of Best Management Practices (BMPs)

Structural BMPs, including dry and wet ponds, wetlands, filtering and infiltration practices (e.g., rain gardens), and swales have been increasingly implemented by communities in response to the Phase I and II requirements. However, recent studies have questioned the ability of such structural BMPs in mitigating the effects of urban runoff on downstream aquatic environments, acknowledging the existence of "ignorance in the scientific and engineering community about what constitutes a properly designed BMP and what it really achieves, with respect to environmental protection" (Roesner, Bledsoe, & Brashear, 2001). Field and laboratory studies of rain gardens, constructed wetlands, and swales have revealed varying levels of pollution reduction, all concluding that these practices alone cannot meet water quality goals or protect aquatic habitat (Davis, Shokouhian, Sharma, & Minami, 2001; Dietz & Clausen, 2005; Pennington, Kaplowitz, & Witter, 2003). This can be especially true in highly urbanized areas with widespread pollution. Roesner et al. (2001) asserts that the effects of polluted runoff are exacerbated by the negative impacts uncontrolled storm water flow can have on aquatic habitat, therefore BMPs designed to address flow control will result in the removal of pollutants.

Beyond the discrepancies and uncertainties regarding the pollution prevention abilities of BMPs, interview respondents with a technical background in engineering or

with other experience and knowledge of BMPs were more concerned with practical issues associated with the standardization of design and application, maintenance, and cost (Table 3.1).

> "...one of the complaints that I hear from the engineers is that they'll say that they want rain gardens but they don't tell you how they want you to do them, so then the engineering firms have to go out and get educated on rain gardens and figure out how to do it and of course all that takes time...I think in general the concept is good...but we're still way down on the learning curve and people still haven't quite figured out what's the best way to do it on a rolling basis so that they can do it repetitively and so forth." (Developer/Builder - P7)

> "...there's also this sort of inertia, this resistance to do new things just because it takes a learning curve you know and that you know takes up time and...on the city side and townships, mostly those people...know there's a new science out there, they're aware of it and most of them...want to figure it out and get going with it and they want to meet their EPA requirements." (Developer/Builder – P5)

Table 3.1 – Barriers and incentives to BMPs identified by participants.

Barriers to BMPs:	**Incentives to BMPs:**
** Cost Maintenance * Construction time ° No standardization of application or regulation ° Uncertainty of water quality benefits	** Aesthetics ° * Recreational value ° ** Pollution prevention ° ° Flood control Increased property values Urban redevelopment

** signifies salience among more than three stakeholder groups, * signifies salience among more than one stakeholder group, ° also found in the literature

The newness of both storm water regulation and technologies presents municipalities with a host of concerns while they try to meet permit requirements and budgets. The CWA states that municipalities must reduce pollution in receiving waters to the maximum extent practicable (MEP) through the incorporation of BMPs (section 402p), both structural and non-structural, unless one of the following conditions is met:

(a) other effective BMPs will achieve greater or substantially the same pollution control benefits, (b) the BMP would not be technically feasible, or (c) the cost of BMP implementation would greatly outweigh the pollution control benefits (Kalman et al., 2000). As mentioned previously in this chapter, financial resources are often limited among municipalities in addition to scientific knowledge and experience, leading local communities to base decisions on expert advice, internal familiarity with storm water management practices, or the lowest cost options irrespective of effectiveness or appropriateness (Kalman, Lund, Lew, & Larson, 2000).

> "...there is a lot of question about using these techniques, will they really hold up under the long term maintenance issues, how much do they really cost, is there a cost savings in the long run, how do we review these projects to make sure that they really are going to hold the storm [water] that we want them to hold?" (NGO Affiliate - P6)

> "Economically, I haven't had a lot of experience so I don't really have a good sense of how they make sense and if they make sense in every application but I know they do in certain ones... my question is just the cost, I think at some point you gotta say, 'wow that's a lot of money' maybe we need to pull back and do something a little bit less, we can still do a lot of good things and I don't have any problem with doing that and I think it's great with doing that, but sometimes you gotta take cost into consideration..." (Municipal Official – P10)

Despite uncertainties, comments regarding innovative storm water practices were generally positive, recognizing the limits of BMPs along with the lack of knowledge and experience that is common with newer practices. The benefits or incentives involved in the implementation of BMPs included aesthetics or increasing green space, pollution prevention, flood control, potential for increasing property values and recreational opportunities, and appropriateness of application in urban redevelopment projects (Figure 3.3). The combined aesthetic and environmental benefits appeared most attractive across

stakeholder groups. This finding was also significant in regards to the proposed storm water retrofit and will be discussed further in Chapter 4.

> "I didn't even know what a rain garden was until two years ago and I'm excited about rain gardens. I personally feel that I want to create as many rain gardens as possible in the township, because not only are they attractive but they create a storm water presence that I think is very acceptable in today's world." (Municipal Official – P8)

> "...one of the big benefits is that it allows you to have your community developed in a way that also keeps the sense of the community in place because in our minds a big part of low impact development is preserving your natural features, and limiting the construction to the smallest area as possible, so it's kind of keeping the look and feel of your community, even though you're allowing development to occur [in] your community..." (NGO Affiliate - P6)

Referring back to Figure 3.1, increasing awareness of NPS pollution has an effect not only on storm water management philosophy and the development of new technologies, but also on federal, state, and local regulation. Similarly, new approaches to natural resource management are also beginning to have an influence on storm water management standards and practices.

Collaboration and the Watershed Approach to Storm Water Permitting

Since the early 1990s, the push for a more holistic and integrative approach to natural resource management has refocused our attention on such concepts as watershed and ecosystem management. A watershed approach to management is rooted in ecological principles and is place-based, integrating natural resource, socioeconomic, and political issues in order to best represent the interests of all interested stakeholders (Clark, Burkhardt, & King, 2005). Brunson (1998) defined successful cross-boundary

stewardship, such as in watershed management, as accommodating "for both the territorial self interest and community cooperation." Significant research has been conducted on watershed partnerships as a method for resolving or mitigating conflict, addressing regional natural resource concerns, engaging stakeholders, or even as a means of enforcing regulations (Burby & May, 1998; Imperial, 2005; Sabatier, et al, 2005; Wondolleck & Yaffee, 2000).

The establishment of collaborative partnerships or cooperative institutions (the terms are used interchangeably) is commonly seen as a strategy for addressing many of the challenges faced in managing natural resources today (Ostrom, 1990; Wondolleck & Yaffee, 2000). Similar views toward collaboration are evident in the recent push for regionalized governmental efforts. At the municipal level regionalization usually relates to regionalizing police and fire departments as a way of conserving resources and ensuring continuity and cooperation across larger areas. Gray (1985) defines collaboration as "the pooling of resources or appreciations by one or more stakeholders to solve a set of problems, which neither can solve individually." Research participants conceptualized collaboration as involving good working relationships, communication, leadership, and a willingness to cooperate that can lead to increased efficiency of resource use and program success.

The benefits of such partnerships range from short-term incentives, including cost sharing and avoiding duplication, to more long-term benefits, such as the institutionalization of policies that could have a greater effect on the entire watershed while also building support for collective action (Table 3.2). Aside from the potential benefits to implementing or instituting a watershed partnership, there are also many

challenges, for instance overlapping and ill-defined responsibilities among multiple organizations, lack of commitment to integrative policies, functional and technical resource management silos, and varying capacity (funding, technical expertise, time, etc.) among governments and agencies (Brown, 2005; Rauch, Seggelke, Brown, & Krebs, 2005; Margerum, 2001). The challenges identified by participants are specific to the Phase II watershed permit, although there are a few overlapping themes from the literature, such as lack of funding, time commitment, turf and ego issues, and methods for evaluation.

Table 3.2 – Benefits and challenges to cooperative partnerships and Phase II watershed-based permit as identified in the literature and interviews

Benefits of Collaboration	Challenges to Collaboration	Keys to Successful Collaborative Efforts
° Avoids duplication ° Cost sharing, economic efficiency ° Working across jurisdictions increases awareness and understanding (social learning) ° Builds relationships and opportunities for future collaboration ° Institutionalization of protective policies (storm water ordinances, zoning and planning)	° Turf issues and egos Organizing a large number of people to work toward a common goal <u>Specific to Phase II permit</u> MDEQ administration of watershed permit ° Lack of funding ° Time commitment Learning curve (lack of awareness among municipal actors and general public) ° Measuring impact of actions and evaluating success	° Individual/agency leadership or outside facilitator ° Willingness to cooperate ° Open communication between partners or information sharing ° Mutual respect and trust ° Capacity building

° also found in the literature

Intergovernmental approaches to environmental planning and management, or 'top-down' policy mandates such as the Phase II watershed-based permit for storm water management, have become more common as agencies attempt alternatives to traditional command and control policies. Burby and May (1998) describe two types of top-down mandates: prescriptive coercive mandates (focused on actions) and cooperative mandates (focus on planning process and capacity building). The Phase II watershed permit is more of a cooperative mandate although it does require each jurisdiction to establish individual action items through the Storm Water Pollution Prevention and Elimination plan (SWPPE). Unlike most permits, the watershed permit is not prescriptive, allowing municipalities the flexibility to decide how to implement the watershed plan on their own. This deviation from the standard permit process has led to frustrations on the part of local municipalities and other regulated entities. These and other challenges can result in a lack of willingness by governmental actors to engage in either 'bottom-up' or 'top-down' approaches in intergovernmental environmental planning (Burby & May 1998; Margerum, 2001; Koontz, 2006). Although participation in the watershed-based permit was not a requirement in meeting Phase II, one participant felt that collaborative efforts are a necessity for local governments in the new millennium.

> "Well, first of all I don't think we have any choice. I feel that we are living in very unique, very different times economically. If anybody thinks they can run their governments alone they are very mistaken. We have to collaborate today, we have to work together, we have to figure out ways that we can save money, we have to figure out ways that we cannot duplicate effort. Regionalization definitely is an important tool that all governments must use. In some ways we're still in an embryonic stage of finding the best way to achieve regional goals." (Municipal Official – P8)

Incentives and Benefits of Collaboration

In the case of the watershed permitting system piloted in Michigan for Phase II of the NPDES, local units of government were given the option of a jurisdictional or watershed-based permit. These watersheds include areas of concentrated development and involve dozens of local government units, intensifying the challenges of regional cooperation. Despite the fact that collaboration among the communities is necessary for meeting the permit requirements, interview participants noted that it has been comforting to be part of the watershed group throughout the process since it is a new experience for everyone. Electing to work across jurisdictions has educated group members regarding shared problems and provided support for resolving these issues individually as well as collectively. Additionally, the permit partnership has allowed agencies, municipalities, and community groups to combine resources (financial and otherwise) for educational efforts with the intent of reaching a wider audience with a unified message.

> "...in my opinion, just the fact that we were forced to come together as a group—and some of [us] did it kicking and fighting by the way—I mean, I didn't want to go to five meetings a month which I did for the first two and a half years, because not only did you belong to a watershed but you also had to belong to a watershed committee, so you not only went to the regional meeting, you also went to the committee meeting, so consequently there were times when I was going to five and six meetings a month and I didn't like that because I felt that I had more important things to do, better things to do, but looking back and at the end of the day I have to admit that it's been a wholesome experience for all us. As many as twenty-two communities came together, in the hopes of making the three watersheds in that twenty-two-community area better, safer, cleaner for future generations and that made it worth it." (Municipal Official – P8)

The watershed planning component of the permit was time-consuming and required a larger time commitment than some participants were willing to contribute, but

they felt it was part of a learning process that helped them understand their constituents and appreciate the various aspects of storm water management (e.g., engineering, environmental, economic).

> "...one of the great things that's come out of it, I think there's a lot better understanding of what this is and we've educated a number of people in terms of this area, the knowledge that the people who sit around the table have now in comparison to what they did know even three years ago is pretty amazing...and...it's people who that's not their background, they haven't had much experience in it and that's really why they weren't aware of it as much as anything...so from that perspective I think it's great." (Municipal Official – P10)

Participants frequently expressed how much they had learned through the process and continue to learn about storm water, other municipalities, BMPs, and related topics. Interview participants learned from each other and took comfort in knowing that they weren't the only ones struggling with storm water issues. Non-governmental interview participants also felt that the facilitation of communication and cooperation between local governments as part of the permit process has opened avenues for future collaboration in other areas.

> "Well I think that they enjoy meeting and working together on things because once they start working together on water quality issues, somehow it's easier for them to start working together on other issues and...they are saying that we have never talked much with our neighbors about certain things or about anything, and now we are meeting on these watershed meetings and we start talking about other projects and start coordinating more. So I think just the whole getting together and meeting, talking is one of the biggest benefits of this program." (NGO Affiliate – P6)

Challenges to Collaboration

Those interviewed who have been directly or indirectly involved in the watershed permit primarily had positive comments regarding the partnership up to this point. They acknowledged that at times it was a struggle to organize such a large, diverse group but

saw this as an inevitable part of the process. Similarly, even with the admittedly territorial nature of municipalities, as well as egos that can be typical among political figures, only three participants mentioned it as being a problem that needed to be addressed.

Whereas the concept behind the watershed permit is to provide opportunities for cost sharing and avoid duplication, interview participants—especially those from smaller municipalities—felt that aside from cost sharing with other communities the financial burden of an unfunded mandate was excessive.

> "...storm water...I think is a real important issue for sure...especially the more I've learned about it since being a part of GLRC, but right now it could be kind of a burden on small communities like us especially since they've had cutbacks on revenue sharing. You know, it makes it tough so everything comes out of the general fund." (Municipal Official – P2)

> "The other frustrating thing I'd say is just the funding aspect of it; I mean, it's a costly project with no real way to recover our costs." (Municipal Official – P10)

> "...the challenge...is the money...there is so much going on, there are so many things local governments in the State of Michigan have to deal with, including the budget crises, that storm water doesn't always rise to the top, and...things like police and fire protection are an automatic; environmental protection isn't always an automatic..." (NGO Affiliate – P6)

The U.S. Government Accountability Office, in a report on the EPA's Storm Water program, found two main factors influencing the level of burden on communities: (a) the extent to which a community can use the flexibility of the permit in implementing less expensive measures, and (b) their ability to benefit from previous storm water management experience (GAO, 2007). This nationwide report reiterates the concerns expressed by research participants regarding the financial burden of Phase II and acknowledges the barriers to funding storm water activities that many communities

confront. Although it is too soon to accurately assess Phase II, the report concludes that the possibility of more stringent requirements in future permits could increase the burden on local communities. This ultimately depends on how the states decide to implement the program statewide, a matter that raised several issues among participants.

MDEQ and Municipalities in Partnership – A Balancing Act

Municipal stakeholders specifically felt that the administration of the permit by the Michigan Department of Environmental Quality (MDEQ) could be improved and at times was detrimental to their compliance with the permit. A few of the more commonly mentioned concerns over administration of the permit related to the newness of the permit for both the MDEQ and municipalities, requirements that were contradictory to the collaborative nature of the watershed permit, lack of understanding of municipal workings, and the exemption of the townships during the permit period. All of which will be discussed in more detail in this chapter. Nonetheless, interview participants felt that the MDEQ staff were good partners in the sense that there were representatives at watershed meetings willing to answer questions the best they could, keeping the lines of communication open. Interview participants empathized with MDEQ staff to an extent because of the newness of the permit for all involved, but were still critical of the permit process and policy administration.

Along with the challenges involved in being part of a cooperative partnership are the challenges to regulating cooperation. Respondents felt permit enforcement by the MDEQ contradicted the cooperative ideals of the watershed permit and attributed some of this to the fact that the MDEQ was still learning how to administer this type of permit.

The regulatory side of the storm water program that is charged with writing and enforcing permits is accustomed to prescriptive permits that, unlike the Phase II watershed permit, clearly dictate what actions need to be taken in order to be in compliance with the permit.

> "We get hit from both sides. People say, well, you know we want to be able to do what's right for us, which to me says we want flexibility, but at the same time they want to know what is it we're [MDEQ] going to accept, which says they can't have flexibility. That's been a very difficult challenge and what we're trying to do is continue to build in, I'd say if there's one major way to look at the change in this round, is that we have set more clear standards for what it would take to comply with the permit but at the same time for most of those standards we have allowed them to submit for approval alternatives." (Government Agency Staff – P3)

Municipal as well as NGO and state agency stakeholders described the management and compliance of the permit as a balancing act between allowing enough flexibility to municipalities for them to meet the permit requirements in a way that best suited their situation and resources, but at the same time having enough structure so that municipalities understood what was required for compliance and that the MDEQ could adequately evaluate compliance for enforcement purposes.

> "We did all this work and then the MDEQ wants to administer the permit as if it's jurisdictional, and almost take and chop everybody up and treat everybody differently...they're learning, [I'm] giving them a little bit of a break I guess, but some of the way they decided to do some of this stuff, it just kind of flies in the face of this cooperative agreement that we've talked about. Okay, you go do this and you guys go do this and it's like, but we all need to work together on this and you're putting up barriers to us doing that and...that's my concern is that it's going to become very localized just based on the way they handled some of the [permit]." (Municipal Official – P10)

> "Well the challenge is that the way a lot of permits are written at the MDEQ and other places, that it's pretty prescriptive and pretty cut-and-dry permit, the watershed process and the permitting process is different than that and so there is a need for more of a collaboration between the communities and a collaboration between MDEQ, there is a need for more trust and flexibility and all of those things are hard to have when you are also trying to check the box and say this community is meeting the permit requirements. So we are trying to meet the MDEQ's needs to be able to show that the communities are meeting what they need to do, but at the same time allow for the flexibility to have this collaboration continue. So it's a little bit of a balancing act, but we think some of the ideas we had for the new permit will allow for that because if communities are allowed to go on one permit, or allowed to have one annual report to the MDEQ instead of ten individual reports, there would be more accountability and self policing within the watershed group than just the MDEQ having to do all of that themselves." (NGO Affiliate – P6)

Even though the permit just completed its first 5-year cycle in April 2008, many groups have recently begun, or have yet to begin, implementing their action items in the watershed management plans; there are already concerns regarding how to measure their success. Because the permit is not prescriptive or performance-based (i.e., the use of measurement and evaluation of benchmarks for improved performance [Karkkainen, Fung, & Sabel, 2000]) similar to other permits, municipal stakeholders are unsure how their efforts will be evaluated by the MDEQ.

> "The bigger issue really is the measurement, because we've done almost every single thing, a lot of those, especially the best management practices, the good housekeeping, those type of things we've always done that. I mean, we've swept our streets forever. That's always been an important thing to the community...but the measurement is really something that we haven't really ever tried to measure you know, how we do that, so that if anything [that] is probably the hardest thing that we've had to do." (Municipal Official – P10)

Evaluating water quality improvements of urban rivers that have endured years of pollution is considered nearly impossible. Research has been conducted using stakeholder perceptions of water quality improvements or watershed partnership success as a proxy

for water quality, but there are doubts about the value (or appropriateness) of this metric since beliefs can fluctuate over time and stakeholders are likely to perceive the effects of the partnership differently. The literature regarding evaluation of watershed partnerships has focused on three areas: (a) process rules or operation, (b) activities, and (c) perceived effects (Koontz, 2006; Leach, Pelkey, & Sabatier, 2002; Margerum, 1999; Sabatier, et al, 2005). Sabatier, et al. (2005) argue that the success of watershed partnerships is dependent on the rules governing the process and the environmental and social context in which the partnership operates. The Phase II watershed permit does not require extensive monitoring, however permit reports do require municipalities to report on their accomplishments through a process of self-evaluation that is similarly focused on activities and operations.

> "I agree that evaluation is very tough. One way to do it I think is to...build into all of their activities, all of their actions, some kind of a feedback loop which allows them to assess whether or not it's effective, so they know—not just us—that it's effective and then they can make adjustments down the road as they need to when these things aren't effective. It doesn't have to be...a go out there monitoring water quality. I don't think that's going to be a great way to do it, but...they need to be diligent considering the evaluation and it needs to be an ongoing process. I think one of the best ways to do evaluation is if they could just document simple things, but routinely...and then just demonstrate what the results are of all these little things that they're doing and from that use it as a learning process, what little things they did didn't work and what little things that did work and so it's almost like journaling and keeping track of how things are going and that's what I think would make the assessment valuable. They could turn around and show us, this is what we did and this is what we accomplished through it, in as simple of terms as they can. I don't have any problem with doing it in simple ways and them not getting way out there with trying to get statistical tests and that sort of thing." (Government Agency Staff – P3)

This quotation reflects the "learning-by-doing" approach to evaluation, which can be further systematized through the use of adaptive management. The application of adaptive management principles in policy implementation can mean more flexible

decision making to account for uncertainty, monitoring of outcomes, and adjustments based on the knowledge gained (Williams, Szaro, & Shapiro, 2007). The public education and participation components of the permit add an additional measurement concern owing to the long-term nature of educational efforts and often delayed results of individual behavior. These aspects will be discussed later in this chapter.

Additional administrative concerns include the 2007 circuit court ruling in favor of Comstock and Kalamazoo Townships, which exempted a majority of the townships from having to participate in Phase II based on ownership and operation of separate storm sewers. The ruling stated that "MDEQ's interpretation and application of its storm water rule to those designated governmental units having the 'power or authority' to regulate storm water discharge but that are not an 'owner or operator' of a separate storm sewer system is an unauthorized and undelegated expansion of such storm water discharge rules and regulations by MDEQ and is accordingly invalid and unenforceable" (State of Michigan, 2007). As a result of the ruling, several communities have left the established watershed groups that were created to help facilitate the watershed planning and implementation under the permit now that they are no longer mandated to participate. In some cases, the townships have agreed to continue working with the other communities on education-related projects, which was the case for one interview participant. However they felt that they should not be required to pay the permit fees or meet any of the other requirements. Other participants (municipal, government agency, NGO, and engineering consultants) expressed concern over the loss of participation by the townships because they felt this would weaken the collaboration that had been built, and that elimination of the township's responsibility contradicted the purpose of the holistic watershed planning

and implementation promoted through the watershed permit.

> "I think by the MDEQ not appealing that decision, that kind of really made sure that we probably won't continue into the future. I just don't see that we'll be able to do it. I don't think there'll be the participation, the will, or anything like that, because people can be disinterested now you know. Before they couldn't be [disinterested], everybody had a responsibility" (Municipal Official – P10)

> "I would like to see some way to bring back the townships into the fold because the court case that just came out has fragmented them—some are in, some are out, some are in [to a lesser extent], even though they're in, and I would like to see them brought back into the fold and I don't know quite how that would happen but, well I do know how that would happen but it's not going to happen right now." (Engineering Consultant – P12)

Owing to the geographical scope of storm water issues, a cooperative approach to management seems fitting. Despite this, regulatory enforcement and compliance can contradict the principles of collaboration. Traditional regulation, which is enforced based on the legal accountability of individual entities, has yet to progress in a manner that can adequately manage cooperative mandates and account for other non-legal forms of accountability including public participation.

Increasing Regulation, Responsibility, and Accountability

Weber (2003) defines accountability as "a system of set mechanisms designed to ensure compliance," meaning that there is "an obligation or responsibility to an authority group, standard, mandate or behavioral norm." When asked who should be responsible for storm water management, there was considerable variation among and within stakeholder groups owing to the difference between types of responsibility (financial, participation or awareness, individual or collective) and the hierarchy of accountability

on account of the trickling down of authority from federal to state to local governments.

The Phase II permit, as a regulatory mandate, holds the local municipalities accountable for meeting permit requirements, thereby increasing the level of responsibility for storm water management. While responsibility is an aspect of accountability, not all responsibility incurs accountability. For example, the ability of the municipalities to meet their permit obligations is partially dependent upon the actions of several actors (residents, businesses, etc.), of whom not all are held accountable in a formal manner such as the Phase II permit. These non-regulatory aspects of responsibility can be considered similar to the ideals of stewardship and will be discussed later in this chapter within the context of public participation and education.

Research participants differentiated between accountability and responsibility by referring to those who are legally mandated to meet certain standards or requirements as accountable. Responsibility seemed to imply a more normative form of accountability, relying on understanding and awareness of the issue that would lead an individual or institution to act based on either a social norm or individual belief. At times the words are used interchangeably by the participants; however, in regards to Phase II, the municipalities are the primary entities that are held accountable by law. The following responses illustrate the relation of enforcement and compliance in accountability.

> "... people may not totally understand it all the time why you're doing something but if it's set up and it's supposed to be done that way that's the way they'll do it. It's a lot easier if you have a reason [to] do it that way, people understand it, then they go forward with it. We are characters I guess, if you say, this is what you're supposed to do and never check up, he may or may not get it done. So there is a level of checks and balances that to the threat of a penalty or a potential of an incentive will get people to pay attention to things. If it wasn't important enough to make it a pay item or an item that had specific inspection then it must not have been that big of a deal and it's treated with less importance." (Developer/Builder – P11)

> "I guess from a local level...we have a lot of responsibility when it comes to [storm water management] and I think without the state having a hammer over our head, or someone saying you guys need to be concerned about this stuff...nothing would have happened with regard to this if that wasn't out there. I mean, they had a voluntary permit for how long...and how many people actually went out [and did that]? Kind of an oxymoron anyway, a voluntary permit, nobody actually understood what it meant so everybody was like, why would I want a permit that I don't have to get?...If the state is not involved I don't think anything happens...There has to be some type of enforcement and I don't know who enforces it if it's not the state, so I think from a local level...we can have a pretty big impact, especially on specific site developments and the city as a whole and then, from the state perspective, I think they have to be there to enforce it to make sure we're doing what we're supposed to do." (Municipal Official – P10)

The interplay between accountability and responsibility are especially prominent when research participants were asked what role developers should play in storm water management. Whereas local and state governments need to be responsible for promoting, setting and enforcing water quality standards, many interviewees thought that developers should feel a sense of responsibility to ensure water quality and be held accountable. Regulation and rule of law again are the main forms of accountability but the various levels of responsibility and accountability appear to be interdependent leading one of the participants to declare a need for equal responsibility by all actors at all levels.

> "Oh I think they need to take responsibility...for the development primarily as well as being aware of and...helping maintain these systems but I think...we need to have development standards that are water-quality friendly, and we need the developers to adhere to those standards." (Engineering Consultant – P1)

> "It's almost like, whose responsibility is it? Well, the political answer is that it's all of our responsibility, it's everyone's responsibility...Yes, we need government regulatory influence there, you need to have laws. We all know people break the laws if there's nobody there to be the police, and then it's their responsibility to follow the law, so I guess from that point of view it's an equal responsibility." (Developer/Builder – P7)

Even though everyone may share in the responsibility of reducing storm water runoff and maintaining clean water, neither accountability nor responsibility can be easily identified in storm water management. The multi-jurisdictional nature of storm drains which cross private and public property and the multi-faceted approaches to storm water management that include everything from encouraging individual behavior change to constructing a wetland can complicate the division of responsibilities and ultimate accountability.

> "Responsible for what? There are various components, such as education, BMPs, illicit discharges, etc., and who is responsible for the different pieces? Lack of accountability is also an issue [in decentralization]." (Government Agency Staff – P18)

> "...being a city, we're the owners of the storm water system so...because of that we're ultimately the ones who should have the big responsibility for storm water management...When you start to talk about other forms of government, I think it starts to make it more difficult. The whole township/county thing is really complicated...We even run into that sometimes when we tie into a county drain. Whose responsibility is it, is it our responsibility? Is it the Drain Commissioner's responsibility?" (Municipal Official – P10)

> "Well that is a difficult question, because you know local governments are tasked with protecting the health, safety, and welfare of their citizens, and yet a lot of the storm water issues are happening on areas that aren't their jurisdiction. So it is a complicated question. I think that between their role of educating the citizenry and making sure that new development considers the environmental impact, that's the role that local governments should have." (NGO Affiliate – P6)

As a result of the increasing regulation on storm water, those that are currently regulated are concerned that if the trend continues they will not be able to meet the level of accountability mandated.

> "I'm getting concerned that we're going [to] continue to be regulated and held to a higher and higher standard, but yet you're just going to...look a blind eye to everything else that's going on,...[that without] having to make very significant changes could have huge impacts by working with the agriculture community..." (Municipal Official – P10)

> "It's easy to get swept up into legislation that says you shall not have any runoff off any piece of property. Some of that's practical, some of it's impractical. But we can and we do. [In] the last ten years I've seen a major change in how people treat creeks and streams. Even 15 to 20 years ago there were some designations going on. When you got anywhere near live streams you had to really protect things. And that's a good thing. But nowadays it's even [more]. Like I said, the pendulum has swung where you don't dare do anything without silt fence up. By the most part it's good." (Developer/Builder – P11)

In conjunction with the reality of increasing regulation is the realization that the individual actions of the general public can't be controlled by regulation alone. The addition of public participation, outreach, and education to the Phase II storm water permits attempts to address this aspect by focusing on encouraging behavior change. Still there is a need to create a sense of responsibility or stewardship, which is something that is difficult to account for through traditional regulatory means.

Public Education, Participation, and Shared Responsibility

Public participation, also referred to as citizen involvement and stakeholder engagement, has become increasingly popular since the 1990s, alongside watershed- and ecosystem-based management initiatives. Public education and participation can mean many things to different people. Traditional forms of public education—public service announcements or primary school curricula—are created in order to change attitudes and influence behavior change over time, whereas public participation is a process used to

incorporate public concerns, needs, and values into government or corporate decision making (Creighton, 2005). Part of this process involves informing the public and soliciting involvement in planning, decision making, and/or implementation. In natural resource management public education programs are more often an aspect of public participation than a separate program, yet a very integral part.

The theory behind public participation is to create a dialogue between citizens and managers, where citizens are both consumers and sources of information (Burroughs, 1999). Duram and Brown (1999) define two forms of communication involved in soliciting public participation: one-way and two-way communication, which can be expanded and used to categorize the forms of education employed in watershed initiatives. One-way communication, or what I will refer to as passive education, is the most frequently used method for community outreach among watershed partnerships and consists primarily of written information such as newsletters, brochures, and websites. Two-way communication involves public hearings, door-to-door contact, or interactive educational programs (e.g., volunteer stream clean-ups and storm drain stenciling) that can have an experiential or social learning element.

Increasing dialogue between the public and agency staff, as well as other stakeholder groups, is important in helping individuals understand different perspectives involved in the resource management issue. As participants in the Phase II watershed permit expressed, participation has enhanced their understanding of each individual representative's perspective and the larger issue of NPS pollution. Normative democratic theory suggests that individuals regularly engaging in public decision making processes are more likely to view their priorities in the context of the larger community, which can

lead to a greater capacity to address collective problems (Weber, 2003). Therefore, investing in public participation efforts that encourage experiential learning, where individuals are interacting and learning how their individual perspective relates to the opinions of others and in relationship to the broader community, can be more beneficial in creating a sense of responsibility among participants than passive forms of community outreach.

For the purpose of this research I will use the requirements in the Phase II permit to frame the intent of public education and involvement since the majority of responses were given within this context. Michigan's watershed permit requires a Public Education Plan (PEP), in addition to the watershed management plan, to "promote, publicize, and facilitate watershed education for the purpose of encouraging the public to reduce the discharge of pollutants in storm water to the maximum extent practicable" (MDEQ, 2003). The public is defined as "all persons who potentially affect the quality of storm water discharges including, but not limited to, residents, visitors to the area, businesses, commercial operations, and construction activities" (MDEQ, 2003). Examples of such programs include storm drain stenciling to educate residents on the location of catch basins and their relation to a local waterway or the distribution of informational brochures on car washing, pet waste disposal, and household hazardous waste drop-off centers.

Public participation is represented in two components of the watershed permit: watershed planning and public education. Stakeholder workshops were conducted throughout the watershed planning process in order to collect public input as part of the mandate requirements. The public is also welcome to participate on sub-committees of

the GLRC, however they do not have any formal decision making role or authority. Because the watershed planning process was not an aspect of this research, I will only address public involvement as it relates to education, outreach, and awareness. Moreover, none of the business owners, managers, or community leaders had any knowledge of the watershed plans that were recently drafted or the stakeholder workshops that were held for community input. In Chapter 4 I will discuss the role of public participation and its relevance in the proposed storm water retrofit, as well as in the recommendations section of Chapter 5.

State or Municipal Role in Education?

Classified it as a tool for pollution prevention and mitigation, public education is considered a non-structural storm water BMP under Phase II. Similar to other BMPs, there is a fair amount of uncertainty surrounding the design and implementation of public education programs on the part of municipalities. The lack of experience and knowledge in this area is greater than that relating to structural BMPs due to the fact that the majority of actors involved in the permit are municipal public works officials with either engineering or maintenance training, or political elected officials. In the case of the GLRC, the committee has been fortunate to receive assistance from Michigan State University Extension, and at least two other watershed permit holders in the state have partnered with local NGOs to help meet this permit requirement. Despite assistance, municipal actors still find the educational requirement to be challenging both logistically and conceptually.

> "...it's a great idea to do it, but...I can see just what a huge undertaking it is to educate all those people. Even just taking a small piece and saying let's work with the K through 12 people, I mean that in itself is a...[challenge] because, first of all we need to educate the teachers and the administrators about what we even want to talk about and then we've got the curriculum issue. Well, how does that fit in with our current state-required curriculum? And then, so once we get past all that stuff we can create the information that we want them to teach in the classroom and they get to figure out [how] they integrate it all in,...So that's just that tiny small piece and that's the educational requirement..." (Municipal Official – P10)

Aside from lack of knowledge and experience, municipal actors expressed a desire for the State of Michigan to take a larger role in public education for two main reasons: cost and consistency of message.

> "Well, my thought in talking to other people involved in this is that the DEQ is the state basically, and if you're going to have a message that you're going to send from the Upper Peninsula to the Detroit area, it seems like you'd want it to be the same...a statewide message. It seems like you'd want to educate all the commercial property owners in the State of Michigan on the same type of issues. So our thought is they develop a large, maybe somewhat general [education program] that can be tailored, but for specific users...and then...each one of the regions can take that information and maybe tailor it to their needs and put it out in the communities, as opposed to us having to go out, find what information [is] out there, modify it to what we need, and then this region has one set of messages, this region has another set of messages, and really the issues are exactly the same between groups and...if you take all the money that's being spent on public education and you gave that to them [MDEQ], the amount of work that they could get done for that amount of money would be three or four times what we can do just because everybody's working on the same thing." (Municipal Official – P2)

While the state's role in educating the public may theoretically make sense, it is seen differently in the regulatory realm. Under the Phase II permit, public education is a regulatory requirement, establishing responsibility on the part of the local municipalities for compliance and the MDEQ for enforcement—or holding the municipalities accountable. Therefore the MDEQ is not mandated to conduct public education on storm water runoff. However, the MDEQ does conduct public education and outreach programs

through their non-regulatory program on NPS pollution. The call for the state to take the lead on education contradicts the current permit requirements and would require a change in the permit that would either establish responsibility on the part of the state or allow for cooperation between the municipalities and MDEQ non-regulatory programs.

> "There are varying opinions in the state about that [state role in education]. There are some, I think it's worth saying, who are of the opinion that, and these are ones who run the regulatory program, who say that this is a regulatory requirement to do public education. The regulatory requirement is placed upon the permittees [municipalities], so it's their responsibility to do it. There is no regulatory requirement placed upon the MDEQ...Now there are others who, within MDEQ, feel that, and these are really those that aren't in the regulatory program, they're others who have done some public education and want to find ways to coordinate what they do for public education with the many things that are done out there at the local level under the permits, to help make the local efforts more effective, those are the thoughts...And I think it's worth putting out there because it could lead...to the local people, starting with the GLRC and anybody else who wants to get involved with this, to come back to the state and say, you know, these are the things that would be helpful and these are reasons we think the state can make our program better. If the state did this or that it would make our program better...But I think that has to be done through our non-regulatory programs like our non-point source program. It won't fly if they come back to our regulatory programs and say, we need you to work with us." (Government Agency Staff – P3)

Whether the state or the municipalities are held accountable for educating the public, both entities share some responsibility in educating various members of the public, including business owners, residents, developers, engineering consultants, etc. Nonetheless, increased awareness does not necessarily translate into behavior change, or compliance in the case of regulation.

Connecting Awareness of Individual Impact to Shared Responsibility

Although urban streams are frequently a point of first contact with nature for

many people, storm water runoff is often not recognized as contributing to water degradation (Paul & Meyer, 2001). In a 2006 survey conducted in the Lansing regional area, 56% of respondents understood or assumed that storm water enters local waterways untreated and 26% believed that storm water runoff was the greatest contributor to pollution in lakes, streams, and rivers (GLRC, 2006). Survey results also indicated that 80% of respondents felt the way they cared for their lawn affected local water quality, however only 27% indicated they had taken action through household activities to protect water quality (GLRC, 2006). Understanding how individual actions affect local bodies of water is seen at the heart of NPS pollution public education and community outreach programs. Most participants agreed that "...the biggest thing the public needs to understand is what they do on the land, on their property, directly impacts the natural waters" (Engineering Consultant – P1). But is awareness enough?

While some respondents felt that increased awareness would create a sense of responsibility among individuals, eventually leading them to participate in pollution prevention activities, others saw a continued disconnect between understanding the importance of clean water and the role of individuals in contributing to or mitigating storm water runoff.

> "...I think it's a really tough message to sell, because it's not very exciting, you know, selling storm water. Non-point or point source pollution is not a big [issue] in the minds of most people that are trying to make a living, and so it's very difficult to sell the message. I think you have to do it in baby steps...We've tried to have press conferences, and it's hard to get a television station or the print media to come to these press conference because they don't understand the concept. I mean, they understand that we need clean water, they understand that clean rivers and streams are very, very important to the environment, all of that they understand, but sometimes selling the message is very, very difficult." (Municipal Official – P8)

This could be a result of the forms of education that are used to convey messages to the public about storm water. Outside of a few storm drain stenciling activities and community events, the majority of educational efforts have consisted of one-way communication materials (e.g., signs and brochures). A few participants saw a greater long-term value in learning-by-doing activities rather than passive education.

> "I think a lot of times you see people put up a sign—that helps. I think when you get like the GLRC, one of their aspects is to go and put up curb markers and...I helped promote that with the idea that you get the education component of the group putting out the markers. They learn something and you get...the participation...and when people actually do something they learn it a lot better than if they just read about it. And you also get the education of the homeowners because they put a little door hanger on their door saying why they're doing this and such. Some are going in with no education, which is dangerous to me because I think we need the education because one of the major challenges we face is the maintenance of these facilities. Who's going to maintain it? Who's responsible?" (Engineering Consultant – P1)

Whereas the municipalities are held accountable by state and federal mandates, other non-government stakeholders that make up the broader community are not legally responsible for storm water management outside of fines for illicit discharges or obtaining permits for construction sites. Responses from business owners and developers often reflected this approach by acknowledging the importance of and need for education regarding storm water impacts and mitigation, but not expanding their level of responsibility much beyond awareness. Community leaders, however, were of the opinion that citizens had a responsibility to be informed and involved both financially and through civic engagement. Municipal officials, being the regulated entity, expressed a desire to see more public involvement.

"...it's the people telling business and government that we need to do something. So if that education is out there and the people start coming to us and say what are we doing about storm water, what can we do differently...why aren't you doing this, that, or the other thing...the support [is] coming now from the people to the municipality rather than the municipality going to the people." (Municipal Official– P2)

Among municipal officials, engineering consultants, and government agency and NGO staff there was a near consensus that developers and contractors need more education on storm water runoff and were not particularly conscientious when it came to protecting water quality on construction sites. One municipal participant felt that, even if a developer or builder is aware, they do not always incorporate this knowledge into their practices. Some participants cited specific examples or incidences from their experience.

"I don't think that the contractors and business owners are very aware of it. As an example, at our own business here they put down fresh mulch the other day, which is great, but they came and they delivered the mulch and they dumped it at the end of our parking lot right on top of the catch basin. Now the guy shoveled the mulch from the pile by wheelbarrow and brought it up here, but there's a lot of mulch next to the catch basin. Well, what is mulch? It's wood, it's gonna degrade. It's just a good nutrient source for the waterways and that's all going to run out to the catch basin. Now, in our case it goes through a natural swale and a detention basin first, so it's not as bad as if it was just going down a hard pipe into the river. But that's an example that I don't think people are connecting the dots yet. I think there' a lot of education that's needed out there." (Engineering Consultant – P1)

"I don't know that the message is quite there yet. You know, we will be watching contractors that never consider the fact that there is a storm drain right there while they are putting in a new sidewalk, and they are just letting all the crap go into the storm drain. So...I honestly don't think the contractors understand all of that." (NGO Affiliate – P6)

"I think they understand it. I'm not sure that they're at a point where they're as interested as they should be...My experience with contractors [is] that their first course of action is just to make money, it's not to fix the environment or to help the environment." (Municipal Official – P10)

However, the developers and builders interviewed believe that they are aware of storm water runoff impacts and that there is a growing awareness throughout the industry.

> "I think they respect the importance of protecting the environment and protecting the water. I really believe that. Nobody, nobody in our industry goes out there and says - you know, we're just going to trash the place; we don't care. I don't see that." (Developer/Builder – P7)

> "I'd say people are committed right now in our industry to build the right road, okay. I would say if they built a good road and it was a good road they'd feel accomplished. If they built the good road and it had no runoff I don't think they would feel any differently about the project. So I don't think it's risen to the level that if they had no runoff and the road was good they would finally feel good. But on the other hand we've come a long way since 25 years ago, 30 years ago where when we used to do pipe work you have to go by a series of trees. You just go through there and the backhoe would bang into the tree and break off branches. Nowadays you see guys go ahead of time [and] if they see a branch that's probably going to get hit they trim it off nicely. So there is an awareness, a growing awareness that we've gotta do better jobs and things like that." (Developer/Builder – P11)

This contradiction could be the result of several factors, one being that the developers and builders that I spoke with represent a minority perspective among the larger population or they see those who lack consciousness of storm water runoff as a minority within their group. Additionally, the quotations remind us of the various sectors that can have an affect on water quality as a result of runoff, including landscaping, cement pavers, well drillers, home builders, road workers, and others aside from general contractors and developers. These responses also reflect how the process of storm water management and regulation has changed over time so that there are discrepancies within disciplines and a variable learning curve. Similar comments were made in regards to the need for more education of municipalities, where even the municipal participants realize

that awareness is usually limited to a few staff and has been increasing over the years as their responsibility to storm water runoff issues has increased. Interview participants from NGOs and engineering firms felt that the municipalities would benefit most from educational efforts, owing to the fact that they have more opportunities to protect water quality through ordinances, zoning, and permitting.

Knowledge of storm water management among business owners and managers varied with about half (6) being somewhat familiar with area practices. Irrespective of their knowledge or understanding, almost all of the business owners (5) did not feel that it was something that they should be responsible for, especially since they are not the owners of the property and therefore not to be held accountable for what occurs on or to the property. Although they were asked about whether or not businesses should be concerned with storm water management, responses primarily related concern with financial responsibility or accountability. One respondent in particular thought that business owners shouldn't have any greater responsibility than anyone else, adding, "It costs a lot of money to go to the moon, but we have to decide whether it is worth it" (Business Owner – P25). Similarly, another business owner acknowledged a more normative responsibility within the realm of not being a polluter, adding, "If I was a big environmentalist I might say more, but don't feel that the business is ultimately responsible or directly responsible" (Business Owner – P23). Two other business owners echoed this sentiment feeling that they should be aware of the issues that affect them in the parking lot, such as snow removal or their own disposal of chemicals, but that the taxes and rent they pay should contribute to handling larger issues.

Community leaders (3) and a local NGO differed from the private sector

stakeholders mentioned above by taking awareness a step further. In particular, they felt that communities needed to take responsibility for local waterways, primarily through financial means and involvement in decision making so that they know how their taxes are being spent. Municipal leaders also agreed.

> "I think we have to start taking responsibility, paying for what we want, you know? There is no such thing as a free lunch, there just isn't, and everybody who is against taxes, I don't know what they expect of their life, or their world or...for anybody, including themselves. I don't quite understand what they think they're going to get for nothing...it's our responsibility whether it be through being involved, or electing good officials, but also understanding that you have to pay for that kind of oversight, you have to pay for clean-ups, you have to pay for what you want." (NGO Affiliate – P15)

> "I think individuals need to be part of any task forces and maybe on a rotational kind of responsibility so that they can know what's going on...These issues become quite dated and...it really impacts your taxes for one, so it impacts the quality of life so individuals should be involved." (Community Leader – P16)

> "...if you want cleaner water you have to pay for it, I'm not sure we're totally there yet but ultimately I think people have to pay for something that better enhances their life. But it's like pulling teeth. You can't convince people that they should pay more taxes, so how are you going to convince them that they should pay an assessment for storm water." (Municipal Official – P8)

Aside from being a regulatory requirement, public participation and increased awareness are necessary components to a storm water management program. Legal accountability, with or without enforcement, is limited in the absence of responsibility. In this sentiment, responsibility can be conceptualized as a form of stewardship where individuals have a responsibility to care for their property, contribute financially, be involved politically, and generally be aware of storm water concerns and how to mitigate their effect on water quality.

Summary and Conclusions

The evolution of storm water management has removed from sight the once unavoidable public health and aesthetic concerns it generated by creating underground pipes. Today technologies such as rain gardens and constructed wetlands are bringing the issue once again into society's purview. In addition to creating a visual storm water presence, regulation and mandated public education are increasing individual and institutional responsibility toward pollution prevention, maintenance of storm water systems, and restoration of local streams. The newness of both the regulation and technologies present challenges to compliance, enforcement, design, and implementation. However, as awareness increases, the uncertainty surrounding these two aspects should decrease.

The application of the watershed approach to storm water management presents barriers and incentives, both perceived and real. In the case of the Phase II watershed-based permit in Michigan, it has helped to increase awareness of storm water concerns, facilitate collaboration, build relationships, and initiate a review of municipal ordinances and practices that could have important long-term implications. The main barriers to success up to this point are primarily a consequence of the newness of the project, which is still a learning process and will need to be revised and adapted to address the issues identified (administration, funding, time, and measurement). One accomplishment thus far has been raising the awareness and importance of storm water management at the local level among municipal officials. The effects of this are difficult to evaluate at this early stage, but continued monitoring and assessment will offer an opportunity for

improvement and learning.

Regulatory mandates that establish legal accountability provide the foundation for environmental protection and appear to be an accepted part of society. However when dealing with multi-faceted and multi-jurisdictional issues such as NPS pollution, the shared nature of the problem requires a shared responsibility that includes those who are not legally accountable. Emphasizing public education and participation that involves two-way communication between government, private businesses, and the public may reinforce the idea of shared responsibility by increasing the understanding of the broader societal concerns.

Chapter 4

The Case of a Proposed Storm Water Retrofit

Examples of innovative storm water best management practices (BMPs) such as rain gardens and constructed wetlands can be found scattered throughout the Greater Lansing area, including the Tollgate Wetlands, Towar Gardens, Michigan Avenue rain gardens, and various locations on the MSU campus. A majority of these projects have been retrofits of existing infrastructure similar to the proposed storm water retrofit for the Frandor Shopping Center and Red Cedar Golf Course. However, this retrofit would involve a mix of commercial and city property on a scale larger than anything that has been done in the State of Michigan to date. Even though a formal design was not unveiled with the expressed intent to submit a proposal, there are many visions.

> "Instead of a vast parking lot of asphalt, the Frandor Shopping Center could be sprinkled with wildflower beds. A pedestrian bridge across Michigan Avenue could link Ranney Park with the Red Cedar Golf Course. The golf course itself will have to be redesigned to accommodate ponds and wetlands and rain gardens. More trails will be built to link the area with the city's river walk complex of trails along the Red Cedar and Grand Rivers. The golf course could also be opened up to light development,...things like an ice cream shop or a miniature golf course or even sand volleyball courts."
>
> (Schultz, *Lansing City Pulse*, July 2007)

While such a project can be a win-win situation for the community and the environment, understanding stakeholder attitudes, concerns, and perceptions is valuable when considering design options, devising public communication campaigns, and ensuring long-term success of the project. Attitudes are a person's way of thinking or

feeling about an object, person, idea, or activity and are frequently used to predict or influence behavior. Perceptions affect attitudes and can be based on the senses (sight, sound, smell, and touch), as well as a person's cultural or worldview. In this case the public may perceive the need for and benefit of a storm water retrofit based on their attitudes toward the aesthetics of the area, water quality of the river, or previous BMP projects in the region and knowledge of storm water concerns and technologies.

Foster (1995 in Knight & Landres, 1998) defines 'places' as "physical locations imbued with human meaning" consisting of three primary characteristics, (a) a landscape setting, (b) a set of associated activities, and (c) significance to people. The places in the Montgomery Drainage District—the shopping center, golf course and river walk—all provide very specific and different landscapes, uses and significance to the people that frequent them. Therefore stakeholder attitudes and perceptions of these areas could provide insight into stakeholder support for or against a storm water retrofit.

For example, the river walk and the golf course provide recreational opportunities that are evaluated using different criteria based on their use. The addition of ponds, sand traps, and rain gardens in the golf course could increase the level of difficulty of the course, which may or may not be welcome by that user group population. Similarly, improvement to the water quality could create new recreational opportunities (e.g., kayaking, fishing, canoeing) on the river and attract more visitors to the river walk who enjoy nature or recreating in a natural setting. However, those who use the river walk as a commuter path from Lansing to East Lansing may never notice any change as long as the path itself is not affected. The shopping center represents an entirely separate set of uses and landscape. The commercial landscape of the shopping center can be aesthetically

pleasing architecturally, based on building design, vegetative landscaping or both.

In the same way perception of place is constructed of various attributes, water can be simultaneously viewed in multiple ways based on the function it serves in society such as aesthetics, conservation, and utility (Nancarrow, Smith, & Syme, 1996; Harris, 1977). These views often interact with and influence each other, such as the effect of aesthetics on recreational use and drinking water. Water clarity and color often shape the public's perception of water quality and the suitability of use for recreational activities. Smith and Davies-Colley (1992) found that green to blue colors were preferred, while yellow-hued waters were regarded as poor and green-yellow waters, marginal. Storm water runoff can increase turbidity in rivers, resulting in a decrease in clarity, as well as causing the color of the water to become more yellow.

On a more general level, a variety of social factors influence public attitudes toward the environment including, sociodemographic characteristics, value orientations, and self or group interest (Steel &Weber, 2001; Van Liere & Dunlap, 1980). Age has been shown to be an important background factor when studying environmental attitudes and concern. In particular, those born after World War II residing in Western democracies tend to give attention to environmental issues more often than older persons (Steel & Weber, 2001; Van Liere & Dunlap, 1980). Studies have also revealed gender differences related to level of environmental concern. Previous studies indicate that women are slightly more concerned about the environment and can be supportive of environmental efforts, especially those local in nature (Mohai, 1992; Steel & Weber, 2001).

Before examining the attitudes, perceptions, and knowledge of the stakeholder

groups regarding the proposed storm water BMP and what influences them, it is important to understand who the stakeholders are. For the purpose of this research, I considered participants that reside in the Greater Lansing area, or use one of the three areas in the drainage district, as stakeholders. About half (17) of the interview respondents would be considered direct stakeholders in the decision making process regarding the storm water retrofit in the Montgomery Drainage District, while the other half are indirectly involved through the watershed-based Phase II permit. Not all those interviewed commented on the proposed project when asked, however those that did comment include shopping center business owners (N=6) and managers (N=3); municipal officials from Lansing (N=1), Lansing Township (N=1), and East Lansing (N=1); an engineering consultant (N=1); community leaders (N=3); and a local NGO (N=1). In addition, questionnaire respondents represent the general public and therefore as a group are also considered stakeholders (N=370).

I will begin by providing a demographic[14] description of the questionnaire respondents followed by a discussion of the similarities and differences in attitudes and perceptions among stakeholder groups regarding the three use areas and the proposed BMP, using both qualitative data from the interviews and quantitative data from the questionnaires. I will conclude with a statistical review of associations between variables and a summary of the findings.

[14] Demographic information such as age and city of residence was not collected for interview respondents and therefore is not presented here.

Description of Questionnaire Respondents

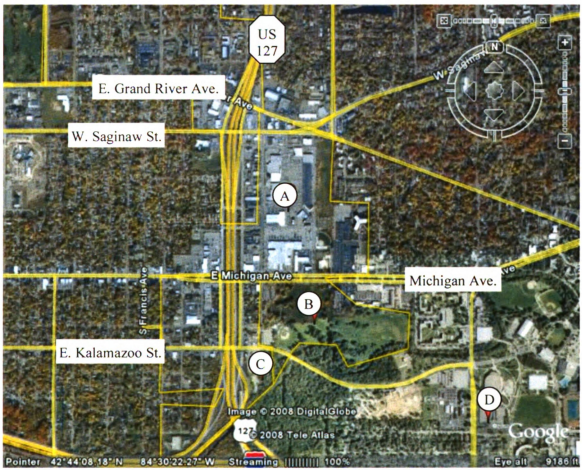
Due to the location of the Montgomery Drainage District at the border of three municipalities (Lansing, Lansing Township, and East Lansing) and close proximity to major highways, the recreational and shopping opportunities in the area attract residents from a wide radius (Figure 4.1). Nevertheless, a majority of questionnaire respondents (64.9%) identified the City of Lansing as their place of residence, and less than 1% resided in areas outside of the Mid-Michigan area[15] or State of Michigan. Fifty-three percent of respondents were male and 45.4% were female. Ages ranged from 18 to 86 years old for a mean age of 43 (Figure 4.2). A diverse array of occupations were represented among respondents, with only 'retired' (13.5%) and 'student' (10.8%) consisting of more than 10% of the total sample. Others included: 'professor' (3.2%), 'store manager' (3.2%), 'teacher' (2.7%), 'homemaker' (2.7%), 'government' (2.2%), 'graduate/law student' (2.2%), and 'unemployed' (2.2%). The higher percentage of retired respondents is a result of questionnaires being administered at the golf course where 26.8% of respondents were over the age of 60 compared to 18.5% for the overall sample and 13.6% for questionnaires administered at the river walk. Similarly, the number of student respondents can be attributed to the close distance and convenience of the shopping center, river walk and golf course to the MSU campus.

Ninety-seven percent (359) of all respondents patronize the Frandor Shopping Center, while only 61% (226) make use of the Red Cedar River Walk and 39.4% (129) frequent the Red Cedar Golf Course. Owing to the fact that nearly all respondents

[15] Other cities and townships of residence in the Greater Lansing and Mid-Michigan areas include DeWitt, Okemos, Haslett, Holt, Mason, Charlotte, Grand Ledge, St. Johns, Williamston, Laingsburg, Fowlerville, Dansville, Howell and Mt. Pleasant.

indicated they use or have used the shopping center, as well as considerable overlap of users across locations, it was not possible to separately compare attitudes and perceptions by user group.

Figure 4.1 – Map of study area

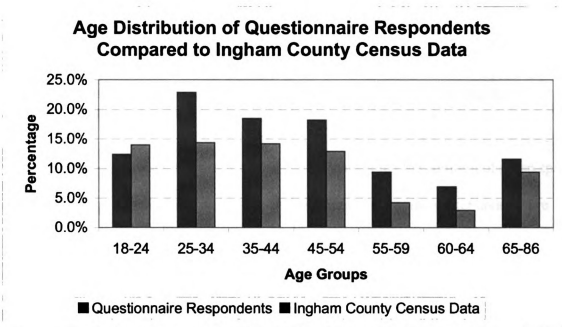


Map created using Google Earth 2008

Legend

A – Frandor Shopping Center
B – Red Cedar Golf Course
C – Red Cedar River Walk access point
D – Michigan State University Campus

Figure 4.2 – Ages of respondents[16]



Stakeholder Attitudes and Concerns

Attitudes toward Drainage District Use Areas—Shopping Center

Interview and questionnaire participants agreed that the Frandor Shopping Center offers convenience by way of its central location, variety of stores and restaurants, and ample parking (Figure 4.3). However, respondents also felt that it could be updated or enhanced by adding green space, making it more pedestrian friendly, and improving the traffic patterns and parking layout (Figure 4.4).

[16] The Ingham County Census Data were retrieved from the 2006 Census conducted by the United States Census Bureau and can be found at http://quickfacts.census.gov/qfd/states/26/26065.html

> "It would be nice if Frandor [Shopping Center] were more pedestrian-friendly, if it were easier to get across the street...from the golf course...I'm not sure that is actually part of a plan to rebuild the drainage...basically just the aesthetics...for usability and friendliness to the neighborhoods...I wouldn't want to see big wetlands that were blocking flow of traffic and flow of pedestrians...I guess I'm thinking [of] that constructed wetland there a few blocks north of Fairview [Tollgate Wetlands]...That's a huge boom to the neighborhood...You can see people day and night walking...Obviously if something like that can be incorporated, it would be very nice." (Community Leader – P17)

Twenty-six percent of questionnaire respondents noted the addition of green space as an improvement to the shopping center parking lot and shopping center area before being asked directly whether or not they felt there should be more green space in the Frandor Shopping Center. When asked directly, 76% (277) responded 'yes,' 5% 'maybe,' 13% 'no,' and 6% 'didn't care.' Three of the six business owners and two of the three business managers also agreed that there should be more green space throughout the parking lot and shopping center area. Including the other stakeholders identified earlier (i.e., community leaders, municipal officials, etc.), 76.4% (13) of interview participants expressed the desire for additional green space.

Among the general public a small percentage (18.5%) felt that the shopping center was fine the way it was and did not need any improvements. Similarly, when asked their opinion regarding the aesthetics of the shopping center area, 38% responded positively, stating that it looked 'good' or 'okay' (Figure 4.3). Conversely, 45.2% of respondents identified the traffic and parking situation as what they liked least about the center, and 17.3% indicated that the parking lot traffic pattern and layout needed to be improved.

Drainages issues in Frandor were not highly recognized by the public, with only 19% having ever noticed any water-related issues in the parking lot or shopping center

area. This response rate may have been affected by the season in which the questionnaire was administered, since it happened to be a dry summer, or by respondents' inability to remember a past event. Of the 65 respondents that were aware of drainage issues in the shopping center, 38.3% noted puddles near Tripper's and the bank, 16% standing water in low spots or middle of parking lot, 13.6% that flooding and sewer overflows from drains were common, 12.3% as a result of snow melt, 11.1% in the past but not recently, and 8.6% in the spring after heavy rains. Nearly all business owners and managers (78%, N=9) indicated drainage issues similar to those noted by the public. None of the businesses interviewed reported any flooding concerns within their place of business. Only one community member was familiar with any drainage issues in the shopping center parking lot.

Figure 4.3 – Questionnaire respondents' attitudes toward the current state of the Frandor Shopping Center

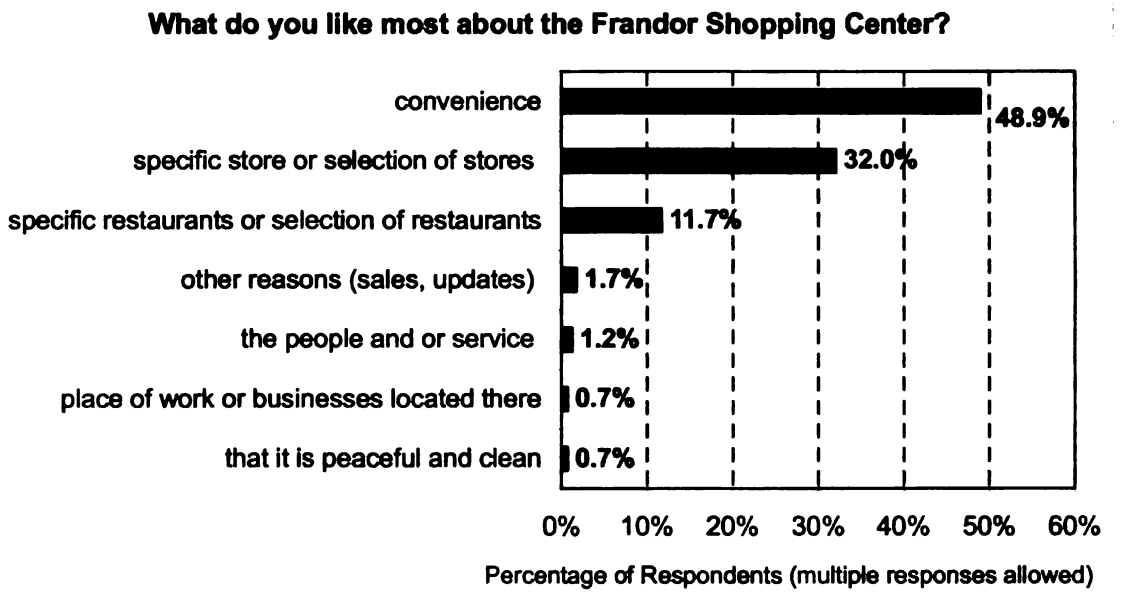


Figure 4.4 – Questionnaire respondents' attitudes toward improving the Frandor Shopping Center

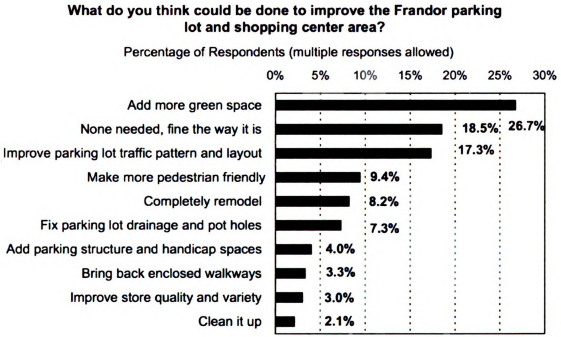


Figure 4.5 - Frandor Shopping Center parking lot, April 2008

Figure 4.6 – Flooding on Red Cedar Golf Course, April 2008

Attitudes toward Drainage District Use Areas—Golf Course

Of the 129 people who said they currently use or have used the Red Cedar Golf Course, 82 (63%) reported having noticed drainage issues on the course, with half of respondents (47%) noting general flooding or standing water, either during spring or after rain events, and the other half indicating frequent drainage issues occurring on or around hole #2 (37.3%) and holes #1, 3, 5, 6, 7, and 8 (15%). While hole #2 was mentioned more frequently, nearly all holes were named, acknowledging a general drainage problem on the entire course (Figure 4.6). A small percentage of respondents (3.2%) thought there needed to be more water on the course to keep the greens, green, which may have resulted from low levels of precipitation levels during the summer of 2007.

When asked what changes could be made to improve the Red Cedar Golf Course,

33.3% said address drainage issues; 28.6% better general maintenance; 26.7% don't change, just keep open; 8.6% redesign and expand; and 2.9% listed more players, more women players and/or speeding up play. Very few of the interview participants were familiar with the golf course and therefore made few or no remarks regarding drainage or improvement.

Attitudes toward Drainage District Use Areas—River and River Walk

Close to half (45.4%, 154) of all questionnaire respondents had a negative impression of the Red Cedar River, stating that it was 'dirty' and/or had a bad odor. Despite this, 23.6% (80) said they liked it, 8.8% (30) felt it was okay, and 25.7% (95) had no impression or opinion of the river or river walk (Figure 4.7). The general perception among questionnaire respondents was that the water quality of the river is average to poor, with 56.7% (149, N=263) rating the water quality as poor, 35.4% (93) rating it as average or fair, and only 8% (21) rating the water quality as good.

The perception of poor water quality among the public appears to be primarily based on appearance (color and clarity), with 56.3% of respondents noting the murkiness or brown color as the reason they believe the water quality is poor. Seventeen percent simply believed it to be poor or made the assumption based on the fact that it is an urban river in an industrial city, and 15.7% based rating on comparisons to rivers in northern Michigan or other rivers that they are familiar with through recreational activities such as camping, canoeing, fishing, etc. (Figure 4.8).

Community leaders and business owners and managers were evenly split, with half having a poor perception of the river and the water quality and the other half feeling

that it was better than before but still average. Only those interviewed that had a more technical understanding of water quality (2) or had been informed by technical experts (1) that the water quality was good rated it as good. Two community leaders also noted their concern over safety when using the river walk, especially for women during the early morning or evening hours.

Figure 4.7 – Questionnaire respondents' impressions of the Red Cedar River and River Walk

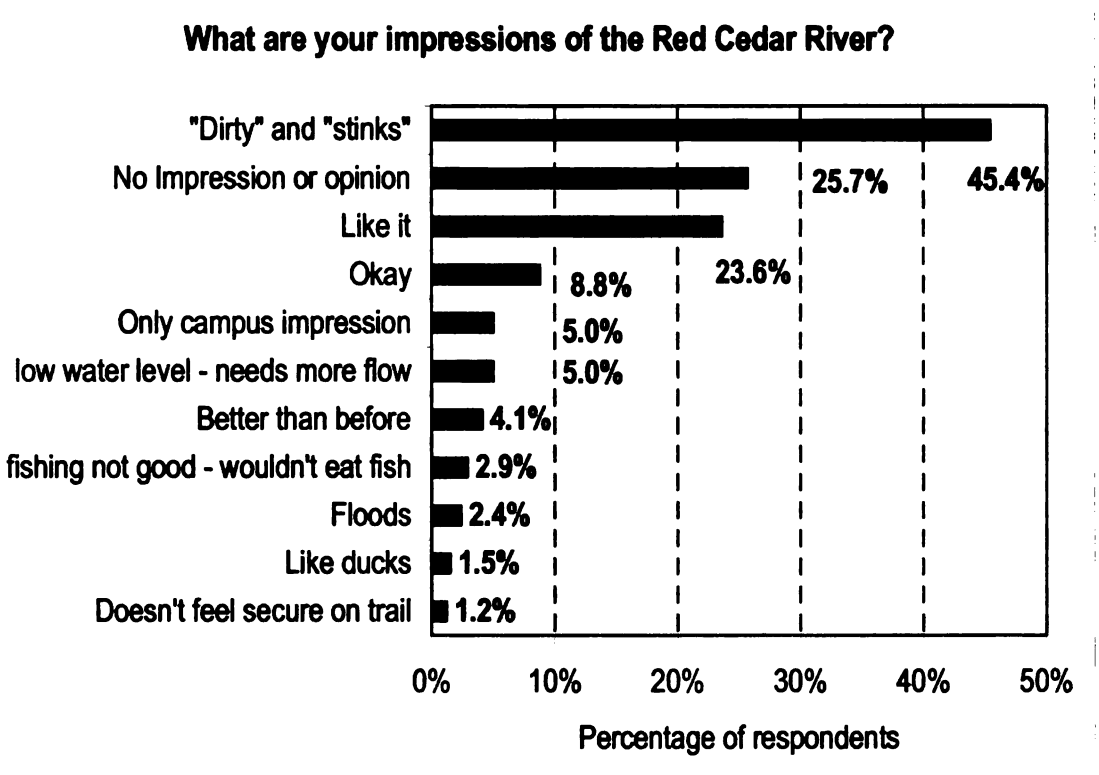


Figure 4.8 – What questionnaire respondents indicated had an influence on the basis of their water quality rating for the Red Cedar River

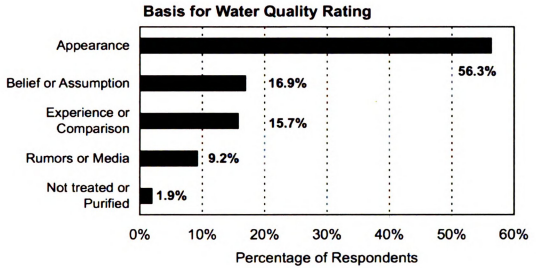


Figure 4.9 – Red Cedar River, June 2007 (photo taken from river walk)

Knowledge of and Support for Pollution Prevention and Natural BMPs

Questionnaire respondents were first asked if they would be supportive of reconstructive efforts in the golf course and/or shopping center that would help improve water quality in the Red Cedar River without specifying the type of support or reconstruction. Seventy-nine percent (294) responded 'yes' without any qualifying statements (Table 4.1). Participants were then asked if they were familiar with rain gardens or constructed wetlands, of which about half (53.6%, 194) were familiar with one or both of these storm water technologies. If the respondents were not familiar with either of these technologies, they were then shown a picture of a rain garden and provided with a brief explanation of both technologies, after which they were asked if they would like one of these technologies to be implemented in the shopping center or golf course. Eighty-eight percent (323) agreed that they would like to see a rain garden or constructed wetland in either of these locations.

Table 4.1 – Selected statements and responses regarding knowledge of, support for, and willingness to pay for a storm water retrofit within the drainage district.

Question	Yes	No	Not Sure/ Don't Know
Would you be supportive of reconstructive efforts in the golf course or shopping center that would help improve the water quality of the Red Cedar River?	91%*	7.6%	1.4%
Are you familiar with constructed wetlands or rain gardens?	52.4%	45.4%	2.2%
Is this something you would like to see in Frandor or the golf course?	88.2%	6.6%	5.2%
Do you feel local residents should pay for reconstructive efforts (storm water retrofit)?	60.8%	31.6%	7.6%

* Of these, 8.9% indicated that it depended on the plan and 2.7% stated that it depended on the cost so that only 79.4% responded yes without a qualifying statement attached.

Not all business owners and managers provided a yes or no response when asked whether they would support reconstructive efforts that would help improve local water quality. The issue of cost, which will be discussed next, appeared to be the main reason businesses were reticent to show support for any reconstruction in the area, as well as lack of information regarding the proposed storm water retrofit. However, four business owners and three business managers did indicate that they would support a storm water retrofit such as a rain garden or constructed wetland in either the shopping center or golf course.

> "Wouldn't have a problem with it, wouldn't affect us since parking is large, would be a problem if people couldn't get in and out of lot easily." (Business Owner – P28)

> "Personally don't think they need a golf course...make it into a wetland walk park...too many golf courses in the area going broke." (Business Owner – P23)

> "Makes more sense for golf course, as for Frandor [Shopping Center], only if it doesn't put people out of business and take away too many parking spaces..." (Business Owner – P21)

> "Would add to attraction of Center and yes, add to business." (Business Owner – P20)

On the other hand, community leaders and other stakeholders (NGO and municipal officials) were more eager to support a storm water retrofit, especially with the prospect of it providing multiple benefits to the community, including recreational opportunities, improved aesthetics, increased accessibility, etc., as mentioned previously. Three interview participants were skeptical of the proposed storm water retrofit for the shopping center and golf course, and would need more information on the cost, design and long-term maintenance plan before supporting such a project.

Attitudes toward Financial Responsibility

Cost appeared as the most consistent concern across all stakeholder groups, except for the NGO/university group. Municipal officials, government agency staff, and developer/builders were mainly concerned with the cost involved in constructing a rain garden or wetland BMP, especially in a retrofit situation such as the Frandor Shopping Center.

> "Money is always a major concern for people, these things are not cheap. That's about a million dollars in construction going in just for the rain gardens themselves, so somebody has to come up with the money...It's possible and feasible; it's just not cheap." (Engineering Consultant – P1)

Business owners and managers were apprehensive to support any type of project for the shopping center because of the direct costs that would be passed on to them

through rent increases or indirect costs as a consequence of the loss of customers during construction. When asked who should pay for reconstruction, business owners and managers (6) clearly felt that they shouldn't be financially responsible using the same reasoning as noted earlier (Chapter 3) in response to responsibility for storm water management where their lack of property ownership exempted them from legal accountability and direct financial responsibility. Any cost for maintenance or improvements to the property was seen as a cost that was already being charged through rent or taxes. This sentiment was reiterated among the general public in the questionnaire as well.

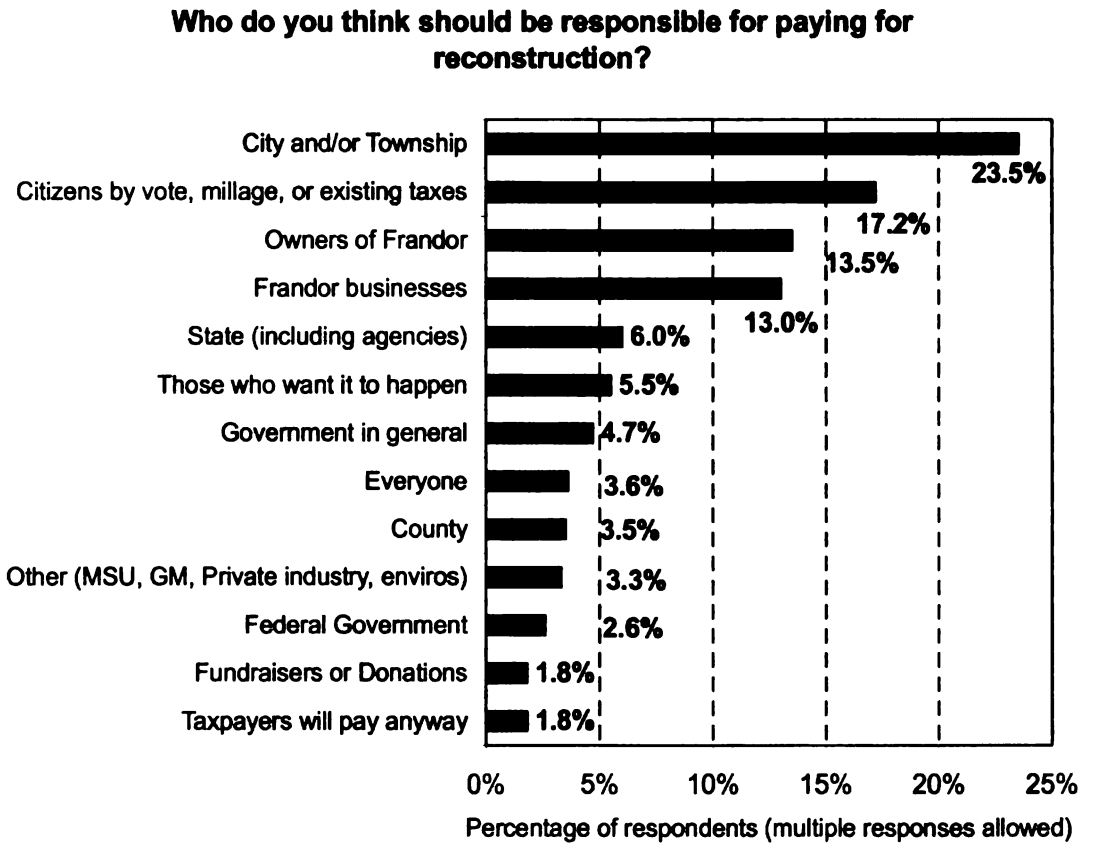
> "Would depend on whose responsibility to pay for it was—as a business owner can't differentiate between financial and other concerns. Construction will be disruptive to business—people change their shopping patterns over 6 months time—leading to loss of business in the long term as well as short term (even big box stores would suffer)." (Business Owner – P24)

The remaining responses regarding financial responsibility for a storm water retrofit varied within stakeholder groups and were divided between government funding—city, township, county, and/or state (6) and a collective effort among government, businesses, and residents (6).

Among the general public, 23.5% (129) of respondents felt that the primary financial responsibility belonged to the city or township; 17.2% (94) the taxpayers or citizens by millage, vote or existing taxes; 13.5% (74) the Frandor Shopping Center property owners; and 13% (71) the Frandor Shopping Center businesses, or a combination of the above. The distribution of all responses can be found in Figure 4.10. Questionnaire respondents were also specifically asked if they felt that local residents should pay for any reconstructive efforts as part of the storm water retrofit. Sixty-eight

percent (225) indicated that local residents should be responsible for a portion of the cost of the project, however, many responses also included a number of qualifiers, such as 'only local residents who want to or by donation,' 'by vote or millage,' 'only if local residents can give input to the proposed plan,' 'through existing taxes,' 'only those who shop there,' or 'would have to anyway through tax increase or increased prices at the stores.'

Figure 4.10 – Financial responsibility for proposed storm water retrofit



Who are the people that indicated they would not support reconstruction or storm water BMP?

While a strong majority of respondents support a storm water retrofit of the Frandor Shopping Center and the Red Cedar Golf Course, it seems necessary to take a look at those who indicated that they would not be in favor of such a project. Twenty-eight respondents answered 'no' when asked if they would support reconstruction of the shopping center or golf course in order to improve water quality, and 24 respondents answered 'no' when asked if they would like to see something like a rain garden or wetland in either of these areas. Only 10 respondents answered 'no' to both questions. A larger percentage of these respondents were male (75% and 79.2%), were over the age of 50 (60.7% and 60.8%), indicated their profession as retired (42.9% and 25%), and were golf course users (50% and 45.8%). These groups also had a higher percentage of respondents who felt there shouldn't be more green space in Frandor (42.3% and 43.5%), said there wasn't anything they liked least in Frandor (39.1% and 54.5%), and didn't believe local residents should pay (60% and 77.3%).

Associations between Support for BMP Proposal and other Variables

My original assumption was that stakeholder attitudes and perceptions toward the use areas would relate to support for the construction of a storm water BMP. However, it was not possible to test for a relationship between 'water quality rating' (WTRQLTY), 'more green space' (GRNSPCE), or 'like least Frandor' (LKELEASTFRNDR), and 'support for BMP' (SUPRTBMP) or 'support for reconstruction for pollution prevention' (SUPRTRECON) because the data violated the assumption of the Pearson chi-square test

of more than 20% of cells with a count less than five. In order to correct for this assumption, individuals would need to be removed from the sample, which would remove, in the case of WTRQLTY, all those who rated the water quality as good.

However, it was possible to use cross-tabs analysis and a Pearson chi-square test for independence to identify associations between 'support for BMP' (SPRTBMP) and 'support for reconstruction for pollution prevention' (SUPRTRECON) with 'knowledge of BMPs' (KNWLDGBMP), 'local residents pay' (LOCAL$), 'gender' (GNDR), and 'age' (AGE), as well as the variables 'age' and 'gender' with 'more green space.' Among the non-demographic variables, LOCAL$ was the only one to show a statistically significant relationship with SUPRTRECON and SUPRTBMP. Table 4.2 summarizes these results.

Table 4.2 – Pearson chi-square values for comparing relationships between variables

Variables	Support Reconstruction for Pollution Prevention (SUPRTRECON)	Support BMP at Frandor or Golf Course (SUPRTBMP)	Gender/Sex	Age
More Green Space in Frandor (GRNSPCE)	****	****	**$X^2 = 6.50^{++}$** (2, N=360) p = 0.039	**$X^2 = 47.967^{++}$** (8, N=357) p = 0.000
Knowledge of BMPs (KNWLDGBMP)	$X^2 = 0.091$ (2, N=357) p = 0.956	**$X^2 = 6.136^{++}$** (2, N=358) p = 0.043	$X^2 = 2.044$ (1, N=357) p = 0.186	$X^2 = 1.76$ (4, N=354) p = 0.782
Support BMP at Frandor and or Golf Course (SUPRTBMP)	****	-------	**$X^2 = 6.483^{++}$** (2, N=361) p = 0.039	****
Water Quality Rating (WTRQLTY)	****	****	$X^2 = 3.359$ (2, N=260) p = 0.186	****
Feel Local Residents Should Pay (LOCAL$)	**$X^2 = 8.425^{++}$** (2, N=338) p = 0.015	**$X^2 = 19.913^{++}$** (2, N=339) p = 0.000	$X^2 = 0.431^{\pm}$ (1, N=337) p = 0.512	$X^2 = 3.332$ (4, N = 335) p = 0.504
Support Reconstruction for Pollution Prevention (SUPRTRECON)	-------	****	**$X^2 = 5.904^{++}$** (2, N=360) p = 0.052	**$X^2 = 40.050^{++}$** (8, N=357) p = 0.000

$^{\pm}$ With Yates Continuity Correction
$^{++}$ Statistical Significance
**** Violates Assumption

Significant associations were found between AGE and GRNSPCE, and AGE and SUPRTRECON. The variable GNDR also showed a statistically significant relationship with the variables GRNSPCE, SUPRTBMP, and SUPRTRECON. While a significant relationship is important, it does not provide any information on the closeness of the relationship or allow for predictability. A closer look at the counts and frequencies between these variables can be viewed in Table 4.3.

Table 4.3 – Counts and frequencies by age group and gender for selected questions

Question		Yes (%)	No (%)	Maybe (%)	x^2	Sig.
Do you think there should be more green space in the Frandor Shopping Center?	Female	137(38.1)	18(5)	12(3.3)	6.500	0.039
	Male	137(38.1)	29(8.1)	27(7.5)		
	18–26	51(14.3)	7(2.0)	4(1.1)	47.967	0.000
	27–36	70(19.6)	7(2.0)	2(0.6)		
	37–49	78(21.8)	7(2.0)	5(1.4)		
	50–61	46(12.9)	10(2.8)	16(4.5)		
	62–86	26(7.3)	16(4.5)	12(3.4)		
Would you be supportive of reconstructive efforts in the golf course or shopping center that would help improve the water quality of the Red Cedar River?	Female	141(39.2)	7(1.9)	19(5.3)	5.904	0.052
	Male	148(41.1)	21(5.8)	24(6.7)		
	18–26	55(15.4)	2(0.6)	5(1.4)	40.050	0.000
	27–36	73(20.4)	1(0.3)	5(1.4)		
	37–49	71(19.9)	3(0.8)	17(4.8)		
	50–61	54(15.1)	9(2.5)	8(2.2)		
	62–86	33(9.2)	13(3.6)	8(2.2)		
Is this something you would like to see in Frandor or the golf course?*	Female	151(41.8)	5(1.4)	8(2.2)	6.483	0.039
	Male	167(46.3)	19(5.3)	11(3.0)		

(%) represents percent of the total responses
* violated the assumption when testing for a relationship with the variable 'AGE'

Summary and Conclusions

The questionnaire results indicate that the public has mixed attitudes about the Frandor Shopping Center, valuing its convenience but acknowledging the need for aesthetic improvements, primarily in the form of additional green space and a redesign of the parking lot to address traffic concerns. Drainage however was not an issue of concern in the shopping center among the public, and only of moderate concern with business owners and managers.

In contrast, drainage was a prominent issue for golf course users. Despite recognition of drainage problems on the course, nearly equal proportions of golf course users felt that the golf course did not need to be improved (26.7%) as those who wanted the drainage issues addressed (33.3%). This is most likely due to the political controversy surrounding the municipal golf courses in the City of Lansing, which involves the Mayor's attempts to close the courses for budgetary reasons against the desire of the City Council and the senior citizen community (Vela, 2008). It is my belief, based on observations and discussions with people at the golf course, that the proposed BMP project was interpreted as another attempt at closing the golf course, and therefore any change was perceived as negative or a threat.

Perception of the river was generally poor while attitudes toward the river walk were more positive—especially by those who use the river walk for recreation or commuting. Similar results were found in a survey of residents in the Rouge River Watershed in Southeastern Michigan where 70% of respondents had a poor perception of water quality, yet 66% visit parks near the river (RRWWDP, 1999). In this same study,

respondents considered improving river aesthetics by removing trash and debris as a high priority. The poor perception of the Red Cedar River appears to also be heavily influenced by the river's appearance, primarily the color and clarity of the water, which doesn't curtail recreational activities on the river walk but discourages other uses by both current users and non-users.

Even though it was not possible to test for a relationship between water quality ratings and support for a BMP in the area, the connection between perceptions of water quality and attitudes toward the river should be considered when communicating with the public regarding the proposed storm water retrofit. The public will need to understand that the biology of the river may never allow it to exhibit clear blue-green water and that the effectiveness of the BMP cannot be measured solely by changes in color and clarity. Furthermore, many upstream sources of pollution have contributed to the river's current state over the years, which cannot be completely addressed through the implementation of a single BMP.

The majority of respondents demonstrated strong support for reconstruction of the area as a means of pollution prevention, and specifically for the use of a BMP, in spite of only half of all respondents having some knowledge or familiarity with such technologies. The significant associations found between support and demographic factors such as age and gender require further statistical analyses in order to draw any specific conclusions or establish causal relationships. Still, the associations found are consistent with the literature. In addition, elevated levels of concern or interest in the environment are not uncommon in university towns where the level of education is more likely to be higher than the average. Because information on educational level was not

collected, it was not possible to test whether this was the case here. However, based on the diversity of occupations indicated by respondents, it is my belief that educational level would not have been an overwhelming factor. Similarly, a 2007 survey of area residents regarding storm water knowledge and practices found a strong willingness among respondents to alter household practices in order to support pollution prevention (GLRC, 2006) This is promising for the proposed storm water retrofit.

Beyond public support for a storm water BMP, interviews provided further insight into the perceived benefits. In the questionnaire, the public's attention was primarily focused on water quality and aesthetic aspects, but interview participants such as business owners, community leaders, and municipal officials conceived of multiple benefits emanating from such a project. Their support appeared to be more motivated by the possibilities the project presented for the larger community, both short- and long-term (i.e., recreation, beautification, improved water quality and increased property value), rather than purely aesthetic or environmental reasons. Other benefits and possibilities of the proposed retrofit were also evident in the questionnaire responses regarding improvements to the area.

Based on the profile of respondents who indicated they would not be supportive of reconstruction or a BMP such as a rain garden or constructed wetland, it seems probable that at least half of these respondents were swayed primarily by the possible impact of the project on the future of the golf course. In addition to individual self-interest related to recreational opportunities, gender and age may have also been a factor in responses among golf course users and non-users. Lack of knowledge regarding the design and cost of the proposed storm water BMP also cannot be ruled out as reasoning

for not supporting such an effort.

Finally, attitudes toward financial responsibility were fairly consistent in that few stakeholders considered themselves financially responsible for a storm water retrofit in the area. Although 68% felt that local residents should pay for a portion of the cost, they also identified government entities (city, township, county, state, and federal) and the property owners (Frandor Shopping Center and Red Cedar Golf Course) as those who should bear the bulk of the financial burden. Since the economy factors heavily in nearly every issue, combined with the current poor state of the economy in Michigan, this response was not unexpected.

Chapter 5

Discussion

My research constitutes an exploratory effort to identify stakeholder attitudes toward storm water management and innovative BMPs, in particular rain gardens and constructed wetlands, within the Greater Lansing area. Interview results show that the watershed-based permit for Phase II has had a positive effect on local municipalities by increasing their understanding of the importance of storm water management and the benefits of collaborative partnerships. Because of the relative newness of the program, challenges to implementation and administration of the permit remain and will require continued education and communication on both sides. The conflicts within the Phase II watershed-based permit between the flexibility necessary for multi-jurisdictional collaboration and the rigidity of traditional regulatory enforcement (i.e., command and control) are largely inherent in environmental regulation in the United States. Due to the magnitude and complexity of this issue, in-depth analysis and recommendations were outside of the purview of my research.

Similar challenges associated with the uncertainty that is innate in innovation were also exhibited with reference to storm water BMPs. Both questionnaire and interview data revealed that while the majority of stakeholders are in favor of the environmental and aesthetic benefits to innovative BMPs, the perceived barriers of cost and time may impede their widespread use in the mid-Michigan region. From a technical standpoint, the uncertainty involved in design, application, and maintenance can also present an additional hurdle that will only be overcome by training and experimentation

in real-world situations. The proposed storm water retrofit does offer such an opportunity, especially with the strong attitudes toward improvement to area aesthetics and water quality displayed in the questionnaire results. However, decision makers should take the time to understand and address stakeholder concerns through public participation that encourages shared learning and responsibility.

In this chapter, I will present a framework for understanding these findings, a set of recommendations for decision makers, questions for future research, and a brief discussion of the limitations in generalizability. I use the diffusion of innovation theory here as a descriptive tool to map the attitudes of stakeholders and provide guidance on how innovation adoption can be influenced. I consider the watershed-permit and storm water BMPs as innovations in regulation and technology that are interdependent and, in this study, cannot be completely separated based on their direct and indirect influences on each other. For the purpose of this discussion, I will also consider adoption as synonymous with support and will focus more on groups of stakeholders than on individuals. These findings have implications for storm water management strategies and policy at the local and state levels; still more research is needed to understand the dynamics of mandated intergovernmental cooperative partnerships and their effect on establishing community responsibility, institutionalization of pollution prevention practices, and watershed protection policies.

Adoption and Diffusion of Innovation in Regulation and Technology

The diffusion and adoption of an innovation explains how an idea, practice, or

object gains acceptance within a social system (Rogers, 1983; Decker & Krueger, 1993). Diffusion can be defined as "the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 1983). An innovation is any technology or idea that is perceived as new to the potential adopter (Rogers, 1983). The factors that can influence the rate of diffusion and adoption include perception of the innovation, characteristics of the social system (structure, individuals, and organizations), and the communication channels used throughout the stages of decision making. Understanding and using diffusion networks can increase the rate of diffusion and induce system-wide change.

In regards to the Greater Lansing area, BMPs such as rain gardens and constructed wetlands have been adopted and implemented as mentioned in Chapter 4, however the diffusion of these technologies has been limited. Likewise, a number of communities in Michigan have adopted the watershed-based permitting system, but not all. While the adoption of this policy in the state is still in its infancy, the perception and communication surrounding this policy innovation will influence the continuation and expansion of the program. The future of this policy is also important to the diffusion of BMPs due to its role in increasing awareness and strengthening communication networks throughout the state, especially since municipalities have the greatest opportunity to implement innovative strategies locally.

Perception of Innovation

The adoption rate of an innovation is influenced by the perception of the innovation, including: (a) relative advantage, (b) compatibility, (c) complexity, (d)

trialability, and (e) observability (Rogers, 1983). Correlating this with the findings, interview participants with more technical experience related to storm water BMPs (engineers, developers/builders) perceived these technologies to have an advantage over previous technologies or strategies for storm water management, however not in all situations. Business owners in particular were skeptical of the direct advantage to them in comparison to the possible economic consequences. An inability to see the individual benefits of rain gardens and constructed wetlands can also have an effect on the public's willingness to invest in such technologies. The uncertainty regarding the relative advantage of BMPs as a control mechanism and a preventive measure weighted against time, space, maintenance, and cost contributes to the low rate of adoption on the local, and, most likely, national level.

Since rain gardens and constructed wetlands are viewed as more natural ways to address storm water and meet multiple needs (aesthetics, environmental and physical water control), they can be viewed as compatible with current societal values and needs based on the interview and questionnaire results. While these technologies can be very complex when considering design, construction, and landscaping, the concept behind their purpose is straightforward and understandable by a variety of stakeholders. The main limitation of such technologies is the degree to which one can experiment with them. Large-scale projects are costly and, with small municipal budgets a constant concern, projects for experimentation would not be readily accepted by the general public or public officials. It is possible for individuals to install small-scale rain gardens in their yards, but they still require a fair amount of time and labor. However, because these projects have been implemented in other areas, it is possible to learn from past

applications. Rain gardens and constructed wetlands are highly visible technologies that can be observed in communities that have adopted and constructed them, giving them higher observability than trialability.

Finally, participation in the watershed permit may contribute to a reduction in uncertainty regarding storm water technologies by being able to learn from the experiences of others. However, in comparison to the traditional jurisdictional permit, it has not yet proven to be a more cost-effective or efficient way to meet Phase II requirements for smaller municipalities. Conversely, among the various stakeholders interviewed, the concept of cooperative partnerships was well received and viewed as a necessity in meeting the challenges presented by storm water. In addition, the watershed permit was created in a manner that allows flexibility and therefore experimentation, offering municipalities the opportunity to make changes to the watershed plan after evaluating the outcomes of program activities. Because of this, the watershed permit has the potential to increase both the observability and trialability of BMPs.

Characteristics of the Social System

Formal and informal social structures exist within a social system, from the bureaucratic structures of local municipalities and other government agencies to interpersonal networks that link individuals (Rogers, 1983). Informal networks tend toward homophily, meaning that the individuals are more likely to have similar backgrounds (education, lifestyle, social status) and beliefs. Even though more effective communication is believed to occur between homophilous individuals because they share a common language, homophilous groups or organizations can be more skeptical of

people and ideas that differ from the norm and therefore more averse to innovation. The successful communication of innovations involves heterophilous (the opposite of homophilous) individuals, groups, and organizations.

The GLRC for storm water management can be viewed as a semi-heterophilous group, representing different professions within municipal government and therefore varied levels of education, social status, beliefs, etc. This group has shown an interest in being exposed to new ideas and changing practices as a means of meeting the Phase II requirements. However, this group lacks representation from community leaders, business owners, developers, and other non-governmental entities. Studies of watershed partnerships have concluded that heterogeneous or hybrid groups consisting of members of the public and agency officials were more effective in planning and implementation than homogenous groups (Moore & Koontz, 2003; Bidwell & Ryan, 2006). Likewise, networks that cross disciplinary boundaries and bureaucratic levels have a greater chance of achieving more equal representation among stakeholders, sharing power, exchanging knowledge, and attaining collaboration (Brown, 2005). The cooperative and multi-jurisdictional nature of the watershed permit facilitates awareness of storm water technologies through interpersonal networks amongst a somewhat homophilous system of municipal actors. However, the influence of the permit and the actions of the GLRC would likely be greater if the watershed group were to increase the diversity of its membership making it more heterophilous.

In the case of the proposed storm water retrofit, the various stakeholder groups involved can be seen as representing a series of homophilous groups (business owners, developers/builders, engineers, municipalities) based on their stake in the project. While

the public cannot be treated as homogeneous, communication is likely to occur between individuals or groups within the public that are more similar to each other. This includes neighborhood groups, local NGOs, and other formal and informal social networks. Use of a combination of communication channels will be necessary in order to diffuse the concept fully throughout the population.

Communication Channels and the Decision Making Process

The communication of new ideas between members of a social system involves the exchange of information, which can both reduce and create uncertainty. The purpose of the innovation-decision process is to diminish uncertainty throughout the following stages: (a) awareness, (b) interest and persuasion, (c) evaluation, (d) implementation or trial, and (e) adoption or support (Rogers, 1983; Decker & Krueger, 1993). Mass media serves as the main communication channel when looking to create knowledge and awareness. However, interpersonal communication is more significant and essential at advanced stages of the decision process. The majority of individuals rely on the communicated experience of those within existing social networks when evaluating the consequences of an innovation rather than scientific studies (Rogers, 1983).

In the Greater Lansing region, awareness of storm water concerns and technologies has increased over the years among municipal officials, engineering consultants, developers, and builders as a result of their increasing legal responsibility mandated under Phases I and II of the EPA's storm water program. However, general awareness is still low within the general population, indicating a need for continued mass communication on the larger issue of storm water. Additional interpersonal

communication —facilitated by opinion leaders or members of a social system that have the ability to influence others based on their technical competence, social accessibility, and conformity to the system's norms—is indispensable in order to progress toward adoption (Rogers, 1983). With a few exceptions, the individuals I interviewed from the various stakeholder groups appeared to be opinion leaders within their professional or community networks. Most of these individuals have previous experience with innovative storm water BMPs or have been exposed to these ideas through the watershed permit, community projects, or advocacy efforts. This aspect of diffusion of innovation theory overlaps with social learning theory because of its focus on the process of information sharing, observational learning, and the effects on behavior and decision making (Rogers, 1983). While this study did not test this facet of the theory, the theme of social learning was prevalent in the interview data.

Individuals or groups progress through the innovation-decision process at varying rates and can be categorized based on when they adopt or are likely to adopt based on various individual and societal characteristics. The categories are: (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards or non-adopters (Rogers, 1983). The following categorization of interview participants and the groups that they represent is based on my own interpretation as well as the participants' perceptions of themselves and the groups to which they belong. Moreover, this categorization is solely in reference to participant attitudes toward innovative BMPs during the time period of the research project, and could change over time or in regards to related issues. Because of this, the following characterization is not universal and cannot be applied to these groups outside of the context of this study.

Innovators, described as venturesome members of society that are not always respected by other members of society, thrive on the daring and risky and are accepting of the occasional setback. The drain commissioner has been the leader, or innovator, of natural storm water technologies throughout Ingham County and is adequately representative of this category based on his initiative in previous projects in the Greater Lansing area and recognition throughout the State of Michigan. Other innovators are present from the engineering and developer stakeholder groups but do not characterize the general attitudes of their broader professional networks, something that was acknowledged by these individuals themselves. These individuals, however, may serve a stronger role as opinion leaders within their professions and tend toward the category of early adopters as individuals. Early adopters are a respected role model for other members of society and usually help to decrease uncertainty by adopting an innovation. Stakeholder groups representing universities, NGOs, and state governmental agencies correspond to this group.

Following the lead of the early adopters is the early majority, or in this case, community leaders, the engineering profession, and county agencies. While the early majority is not considered a leader, there has been some leadership on the part of engineering consultants in the Greater Lansing area. Some members of the public and GLRC participants could also be classified as early majority, particularly with the strong showing of support for the proposed storm water retrofit. Still, about half of the public and municipal officials would most likely be considered part of the late majority, which is more skeptical of new ideas and influenced by the utility or necessity of the innovation or peer pressure, owing to cost concerns.

The remaining stakeholders—developers, builders, business owners, and managers—comprise the laggards or non-supporters. These groups are more skeptical and risk averse than the above groups, part of which can be attributed to limited resources that inhibit them from adopting or supporting an innovation without some certainty of the expected benefits and degree to which it would disrupt other aspects of their life or business. Again, individuals within these stakeholder groups may differ from the majority, therefore it is important to identify opinion leaders that have credibility within these professional and social networks to assist in the diffusion and adoption of innovation.

Recommendations

Decision makers should work toward becoming more comfortable with the uncertainty involved in preventive measures and move away from the old paradigm of only responding to storm water problems. Planning at the watershed level in cooperation with other jurisdictional entities is a step in the right direction. Increasing the awareness of storm water management strategies and learning from the experiences of others should help reduce the uncertainty regarding innovative BMPs such as rain gardens and constructed wetlands. In addition, experimentation should be promoted within these projects so that communities can learn, instituting a feedback loop and hopefully reducing uncertainty in future projects. A combination of adaptive management (Holling, 1995) and democratic experimentalism (Dorf & Sabel, 1998) may provide a model to assist in decision-making, monitoring, and follow-up.

Uncertainty is valued in adaptive management because of the potential for knowledge gain and social learning (Lee, 1993). Both theories promote this feature by means of local experimentation and collaborative decision making in achieving improved environmental performance. Experimentation in policy requires decision makers to justify their actions based on the significance of the problem and not the certainty of the outcome (Lee, 1993). However, this should not diminish accountability on the part of decision makers and is where performance-based regulation can connect "promises with outcomes" (Weber, 2003). Democratic experimentalism also advances broad-based accountability through public participation in decision making, benchmarking, and performance monitoring[17] (Karkkainen, et al., 2000; Weber, 2003). This level of participation will place additional power, as well as demands, in the hands of citizens and will require a shift from those who are *likely* to participate to those who *should* (Duram & Brown, 1999).

In addition to the broader organizational and institutional issues above, the practical matter of cost still prevails. The combination of increasing regulation, decentralization of responsibility, and acute environmental degradation calls for additional municipal funding in a time when municipalities are already feeling overburdened and the public overtaxed. While beyond the scope of this project, storm water financing is vital to addressing local concerns related to public health and environmental quality. In most cases, storm water programs are funded through the general tax fund or property taxes and must compete with several public services. Various strategies such as storm water utilities, which charge a user fee, are currently

[17] Performance-based monitoring utilizes the measurement and evaluation of benchmarks for improved performance.

being used around the country to help generate dedicated funding for upgrades to drain systems, BMP construction and maintenance, flood control measures, and administrative costs (Debo & Reese, 1995; Kaspersen, 2000). Because of Lansing's controversial history with storm water utilities it might not be the appropriate tactic for the area[18]; nonetheless, addressing NPS pollution necessitates allocated funding at the local level in order to restore and maintain current systems while preventing future problems (Kaspersen, 2000).

Phase II Watershed-Based Permit

The MDEQ should work to integrate non-regulatory programs, such as NPS educational efforts, with Phase II communities in order to enhance the effectiveness of public education programs. Although Phase II communities indicated a need for more financing options in these early stages of the program, other support at the state level is needed, such as providing educational materials, messaging, and guidelines for K–12 education (especially in light of increasing standardized testing requirements). Nonetheless, passive educational efforts such as signage, brochures, and websites are not enough. Educational efforts that work to involve community members and convey the individual and collective impacts and benefits are essential. Just as the Phase II communities have learned from and with each other through the process of the permit, community members can learn by working together with municipalities through neighborhood groups. At present, residents approach the municipality only when they

[18] The City of Lansing attempted to institute a storm water utility, known locally as the 'rain tax,' that was deemed unconstitutional by the Michigan Supreme Court in 1998 because it was determined to be a tax and not a user fee. It would have been allowable under Michigan Law if it had been approved by public vote as a tax, since a city is only allowed to collect fees for services, but not assess taxes. (Kaspersen, 2000; D. Drullinger personal communication)

have a problem with storm water. Therefore it is up to the municipality to approach the public and bring them into the watershed plan and pollution prevention (or restoration) projects to help establish ownership, trust, and a sense of stewardship. Volunteers also need a reason to participate and are more likely to engage in an issue than an external state-fostered process (Michaels, 2001).

Communication through interpersonal networks could provide a more effective use of time and money than the production and distribution of newsletters and factsheets. Because municipalities often have direct contact with business owners, homeowners, homebuilders, riparian landowners, developers, engineers, and other individuals through various avenues, their continued engagement in public outreach is key to creating a dialogue with local-level actors. Building on the EPA and MDEQ sponsored trainings for developers, municipalities, and engineers that assist them in understanding and complying with new regulation, these programs could be expanded to address more localized issues and involve community members. Funding could also be directed at bringing in speakers from other areas of the country to share their experiences with innovative BMPs, storm water ordinances, public outreach, or watershed planning. Other organizations in the state such as the Southeast Michigan Council of Governors[19] and the Michigan Water and Environment Association,[20] have been active in organizing field trips to showcase projects throughout the state, but their target audience is focused on the technical and professional actors in water resource management. More involvement of legislators, community leaders, and private businesses would be valuable. While it may not be realistic to have high levels of participation by all stakeholders, a concerted effort

[19] www.semcog.org
[20] www.mi-wea.org

to engage stakeholders from key social networks should ensure that a wider audience is informed.

Montgomery Drain Storm Water Retrofit

Communication strategies aiming to garner support for the project should engage the community in developing a vision for the area that encourages a broad sense of ownership of the project. Because storm water management is an increasing cost to municipalities and residents, public outreach surrounding the proposed retrofit should include information about cost and financing, not just the detrimental effects of NPS pollution and the environmental and aesthetic benefits of BMPs. This is an opportunity to increase awareness of storm water management and financing, clarify government and community responsibilities, and communicate the long-term benefits to the community. Furthermore, community members in addition to those that own property within the drainage district should be involved in the decision making process. In particular, business owners who lease commercial/retail space in the shopping center or surrounding area should be consulted since they have the potential to be the most negatively affected (and inconvenienced) in the short term. Every effort should be made to address their concerns.

Finally, attitudes toward the Mayor of Lansing and the Ingham County Drain Commissioner appeared to influence support for the project among some members of the community. Because both of these actors will be implicitly involved in any proposed storm water retrofit within their jurisdictions it would be impossible to remove their presence. However, establishing a diverse coalition of organizations in support of this

issue might help to bridge the political and ideological divides.

Areas for Future Study

The watershed approach to management, storm water regulation, and innovative BMPs are all recent phenomena that have developed over the last 20 years. Currently the majority of research related to watershed management focuses on rural areas and voluntary watershed councils or groups, often not distinguishing between how or why the partnerships were formed. Communities in Michigan regulated under Phase II represent a mix of urbanized and rural watersheds with a diverse set of problems and solutions. Watershed groups that are established for the sole purpose of meeting mandated requirements may differ significantly and would benefit from research dedicated to this type of institution.

Michigan is still in the early stages of the watershed-based permitting system for Phase II; this presents a good opportunity to monitor the formation, function, and outcomes of these groups. Case studies of municipalities under the watershed-based permit around the state could be useful in understanding the limitation of Phase II for certain communities and for comparison of successes and failures. Some of the questions to be addressed are: Does regulating collective action reduce or increase the possibility of institutionalization of management practices? (Have we found the right balance between the carrot and the stick?) What contextual factors aid in the success of these partnerships? How do we enforce compliance and measure success of cooperative mandates?

Although Phase II has a top-down focus, a key component of the watershed-based

permit requires public participation and education. This provides an opportunity to build on the literature regarding public participation programs of federal natural resource management agencies by bringing in the layer of local government. In addition, it may be useful to map the social networks within the watersheds as a means of investigating the influence various stakeholders have on process and outcomes, and draw comparisons between communities. A similar study could be used to understand the role institutional structures (regulation, citizen support, political leadership) play in the implementation of innovative BMPs.

Staying true to the technical roots of water management, the majority of the literature related to storm water management has focused on the engineering aspects of flood control and pollution prevention or the more chemical and biological aspects of water quality. Human dimensions research dedicated to water resource management that integrates the fundamental water services provided to citizens by local governments, along with ecological and recreational services and needs, is lacking. How do you instill a sense of responsibility or stewardship for a community resource such as water (irrespective of property rights or personal health), which is perceived and valued in multiple ways? Some additional questions include: What influences willingness to pay (knowledge, necessity of project, trust in local government, values/beliefs, etc.)? How do you communicate risk associated with water quality without creating or reinforcing a negative perception of the river? Similarly, how do you educate the public about storm water and persuade the public to support large-scale improvements while also promoting individual behavior change?

While considerably less has been written about storm water management, I

suspect that this trend will begin to change as Phase II implementation continues, demonstrating the application of the watershed approach in urbanized areas.

Research Limitations

This research represents the attitudes, perception, knowledge, and practices of current stakeholders and was conducted under the circumstances presented by recent regulation, as well as the present social, economic, and political environments. Owing to the influence of these factors on storm water management and their constant state of flux, the generalizability of this research to other regions or time periods is limited. As an example of the rate of change, two of the businesses that were interviewed for the study have since gone out of business in less than a year's time. Future elections could also replace current decision makers with varying attitudes and awareness of storm water concerns. More specifically, the following limitations should be taken into consideration.

The Phase II program is still in its infancy and constantly evolving, with revisions to the renewed watershed-based permit already in effect. Further research will be necessary to fully evaluate the long-term influence of the program on awareness and environmental quality. Moreover, I did not interview a representative sample of GLRC members, focusing instead on those with jurisdiction over the Montgomery Drainage District along with stakeholders outside of the GLRC. Therefore the statements made regarding Phase II may not fully represent the attitudes of the GLRC overall and conclusions or suggestions made are limited to the experiences of those interviewed. Nonetheless, the information presented regarding the Phase II program could prove

useful to similar programs throughout the State of Michigan or the country as a means for comparison and program revision.

In regards to the storm water retrofit for the Montgomery Drainage District, an official proposal has yet to be prepared; hence, questionnaire respondents did not have a specific design or BMP to comment on and were instead responding to the possibility or idea of a BMP that would most likely resemble other recent area projects, such as the Michigan Avenue or Towar Gardens rain gardens or Tollgate Wetlands. Their response and support was also dependent on familiarity with the above BMPs, otherwise their opinion was based on an image and brief description provided by the interviewer. Consequently attitudes might change over time once more information regarding the type of BMP, cost (tax increase or special assessment), and placement (Frandor Shopping Center or Red Cedar Golf Course) is finalized. Decision makers will need to take this into account when viewing the conclusions and recommendations.

Despite the lack of a specific design or plan, some news media reports regarding the possibility of a project proposal were released within the first month of the study and then a few months later. While only a small number of people mentioned seeing the local television spot or reading the news article, this could have had a greater affect on respondent attitudes or willingness to participate in the study. I chose not to measure this possible effect since the first news story occurred before the questionnaires or interviews had begun. If anything, I feel that it may have increased the willingness to participate in an interview among a few of the business owners and managers since it afforded them the opportunity to voice their opinions.

Furthermore, although I did not collect information on political orientation, there

may have been a correlation between either political orientation or support for particular elected officials and their willingness to support such a project. This is a politically charged issue associated with political figures, which could also have influenced people's feelings toward the project. Various comments were made referring to the Governor of Michigan, the Mayor of Lansing, and the Ingham County Drain Commissioner throughout the questionnaires and interviews but were not formally collected. Worldview and political ideology proved to be adequate determinants for predicting support of BMP implementation in a study of the Sycamore Creek Watershed (part of the Red Cedar Watershed), and may have had some bearing on attitudes here as well (Pennington, 2002). Because I did not collect information to measure any difference in attitudes toward BMPs based on political orientation or satisfaction with the current political administrations, the conclusions that can be made regarding willingness to support innovative technologies in retrofit situations such as this are limited.

Finally, all watersheds are different ecologically, socially, and politically, and vary throughout time. While this study may be important in understanding stakeholder attitudes toward storm water BMPs and retrofits in the Greater Lansing area, it may not transfer to other areas based on current social, political, and economic factors. Storm water practices and regulation will continue to evolve as the extent of our environmental degradation deepens and societal values, beliefs, and attitudes shift. However, these findings aid in augmenting our knowledge for analyzing similar situations and offer practical recommendations for the case at hand.

APPENDICES

Appendix A: Interview Topics and Sample Questions

Knowledge or Experience with Natural BMPs

Have you been involved with any alternative or natural storm water management practices? What has been your impression of these projects?

Do you feel these alternatives are feasible? Why or why not?

Multi-jurisdictional Cooperation and Phase II Watershed-based Permit

Are you involved in any collaborative projects with other jurisdictions (state, county, city, township) or agencies (health department, MDEQ, MDNR)? If so, could you describe those projects to me?

What has been your impression of working on multi-jurisdictional projects?

What is your involvement, if any, with the Greater Lansing Regional Committee for Storm water Management? How would you assess your involvement in this process?

What would you consider to be the benefit of watershed planning in this manner? And the challenges?

How would you like to see the watershed planning process proceed in relation to storm water management?

What are the incentives and disincentives to meeting storm water regulation in your field of work? How could the current process be improved?

Public Education and Awareness

Do you think the general public should be concerned with storm water management? Why? What do you feel would be most important for them to understand?

Do you feel they know enough about these issues? What do you think they should know?

Do you feel that municipalities, contractors, developers, etc. understand storm water issues and their environmental effects? Why or why not?

Responsibility for Storm Water Management

In your opinion, what should be the role of government (local and state) in storm water management? And the level of responsibility?

What about the role and level of responsibility of community members, local business owners, and private developers?

Do you feel businesses such as yours should be concerned with storm water management? Why or why not?

What level of responsibility do you feel businesses have in preserving water quality of local water bodies?

In your opinion, who should be responsible for storm water management?

Knowledge of and Participation in Storm Water Management

Were you involved in any of the stakeholder workshops that were conducted during the development of the Red Cedar Watershed management plan? If so, how would you assess your involvement in this process? (Positive and negative aspects)

Are you familiar with the Greater Lansing Regional Committee for Stormwater Management and their activities? If so, how did you become aware of them?

Are you familiar with storm water management practices in the area?

Do you feel that you, as an individual, contribute in any way to storm water runoff? How?

*Additional questions regarding the Frandor Shopping Center, Red Cedar Golf Course, and Red Cedar River Walk from the questionnaire were also asked.

Appendix B: Questionnaire

Interviewer Name:	Interview Time: _____ AM PM
Interview Date: ____/____/2007	Interview Location:

INTRODUCTION – As part of a Michigan State University study to better understand the knowledge and attitudes of community members regarding environmental conditions in urbanized areas we are asking persons along the Red Cedar River or Golf Course and in the Frandor Shopping Center to complete a short interview about their use of these areas. The interview may last from 3–7 minutes depending on your interest. Your participation is strictly voluntary, and confidential. The information collected will be shared with policy makers to assist in future planning of these areas.

1. Do you, or have you, ever used the Red Cedar Golf Course?	**YES** **NO** *(if no skip to Q #4)*
1.1 If yes, how often?	
2. Are you aware of, or have you noticed any water or drainage issues associated with the golf course?	**YES** **NO** **DON'T KNOW**
2.1 If yes, what are they?	
3. What changes could be made to improve the golf course?	
4. Do you use the businesses in the Frandor Shopping Center area?	**YES** **NO** *(if no skip to Q #8)*
4.1. If yes, how often?	
5. What is your impression of the Frandor Shopping Center? *(if they don't use the shopping center but are familiar with it, still ask Q #5 – 7.2)*	
5.1. What do you like most about the Frandor shopping center and surrounding area?	
5.2. What do you like least?	

6. Have you ever noticed any water related or drainage issues in the Frandor parking lot?	**YES** **NO** **DON'T KNOW**
6.1 If yes, what are they?	
7. Aesthetically speaking, how do you like the Frandor parking lot and shopping center?	
7.1. What do you think could be done to improve it?	
7.2. Do you think there should be more green space (trees, grassy areas, flower beds)?	**YES** **NO** **NOT SURE** **DON'T CARE**
8. What are your impressions of the Red Cedar River?	
9. Do you use the river or river trail?	**YES** **NO** *(if no, ask Q #9.2)*
9.1. If yes, what for and how often? **9.2. If no**, why not?	
10. How would you rate the water quality of the river? *(ask even if they don't use the river unless they don't know it exists)*	**GOOD** **AVERAGE/FAIR** **POOR** **DON'T KNOW**
10.1. Why do you rate it this way? **10.2. If poor**, what do you think contributes to the poor quality?	
11. After it rains, where do you think the water that falls on the Frandor parking lot goes?	

CONTEXT: This research project is studying storm water runoff and management issues in the Greater Lansing area. In urbanized areas where a significant amount of area is paved (such as the Frandor Shopping Center) rainwater is directed to storm drains, often carrying garbage, oil and grease, dirt, and anything else that settles on the roads or in parking lots. This water is then released untreated directly into local streams, such as the Red Cedar.

12. Knowing this, would you be supportive of efforts to reconstruct the shopping area and the golf course in a manner that would reduce water pollution in the Red Cedar River and possibly create a more aesthetically pleasing shopping area and golf course?	**YES** **NO**
13. Are you familiar with constructed wetlands and rain gardens used in storm water management, like those in the Groesbeck neighborhood or shown in this picture?	**YES** **NO** **DON'T KNOW**
13.1. Is this something you would like to see in the Frandor Shopping Center or Red Cedar Golf Course?	**YES** **NO** **DON'T CARE**
14. Who do you think should be responsible for paying for reconstruction?	
14.1. Do you feel local residents should pay for reconstructive efforts that would improve the water quality of the Red Cedar River?	**YES** **NO**

DEMOGRAPHIC INFORMATION

Do you live or work near this area? (Frandor, golf course or river walk) *Please make a note if they work in a store or restaurant in Frandor*		**YES** **NO**	
What city and neighborhood do you live in?			
Sex	**FEMALE** **MALE**	Occupation:	
Age		**INFO SHEET PRESENTED: YES (circle)**	

Thank you for your participation and have a nice day!

Appendix C: Observation Log Sheet

Date:		**Start Time:**		**End Time:**	
Weather:		**Location:**		**Interviewer Name:**	

RIVERWALK	**TALLY**	**TOTAL**
# of Bikers		
# of Joggers		
# of Walkers		
# of Rollerbladers		
Other (fishing, canoeing, people sitting in their cars in the parking lot,...etc.) Please specify.		

For River walk and Golf Course ONLY	
# of cars in parking lot at start time	
# of cars in parking lot at end time	
For FRANDOR ONLY	
Parking lot full, ¾ full, ½ full, ¼ full or empty	
FOR ALL LOCATIONS	
Rate pedestrian flow as high, medium, low	

Other Comments or Observations:

Red Cedar River Walk, March 2007 (above) and February 2008 (below)

Frandor Shopping Center, June 2007 (above) and February 2008 (below)

Red Cedar Golf Course Club House, April 2008 (above)

Red Cedar River Walk, September 2008

Red Cedar River Walk, June 2007 (above)

Red Cedar River, May 2008 (taken from river walk)

Appendix E: Interview Themes and Codes

THEME - COLLABORATION

People Challenge to Collaboration

Communication for Collaboration

Avoid duplication

Cost Sharing

Hope for Partnerships

Trust & Flexibility

Leadership

Working across jurisdictions

Turf issues & egos

Support of Group

THEME - ATTITUDES toward BMPs

Aesthetic Benefit

Flood Control

Environmental Benefit

Developer Benefit from BMP

Disruption of Business

Collected Pollutants Concern

Economic Benefit

Time Concern

Limited benefits for water quality

Maintenance Concern

Cost Concern

Emerging Technology

THEME - ATTITUDES Phase II

Change in Philosophy

Forced Collaboration

Increasing Regulation

Inconsistent Regulations

Time Commitment

Watershed Permit

General Permit

Township Issue

Increased Awareness

Awareness = Participation

DEQ Admin

GLRC Participation-NO

Lack of Funding

Learning Process

State Role in Education

Measure of Success or Impact

THEME – RESPONSIBILITY

Business Responsibility

Community Responsibility

Municipal Responsibility

Trickle Down Responsibility

Shared Responsibility

Developer Responsibility

Drain Commissioner Responsibility

Need for Regulation

Property Owner Responsible

THEME – EDUCATION/Awareness

Developers & Contractors Aware

Developers & Contractors Need Education

Educate Businesses

Educate Municipalities

Educate Regulator

Educate Voters

Educating is Difficult

Educating Legislators

Education through Schools

Engineers Need More Awareness

Public Education

Public Participation

Individual Impact

Lack of Awareness

THEME – Red Cedar Impressions

Fair Impression of River

Better than it was

Good Water Quality

Poor Perception of River

River Walk Safety Concern

THEME – Attitudes Frandor

Yes Frandor Proposal

FRNDR- Needs Update

FRNDR- Pedestrian Friendly

FRNDR-Multiple Benefits

FRNDR-Needs Green Space

FRNDR-Traffic Improvement

FRNDR - Biz should pay

FRNDR - Biz shouldn't pay

FRNDR - City/County/Twp/State pay

FRNDR - Everyone Pay

FRNDR - Owners Pay

Senior Citizen Constituency

Golf Course

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