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An integrated environmental management case study: the Upper Sugar River watershed initiative

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Abstract. Integrated environmental management (IEM) is an innovative approach to resource management that has been increasingly experimented with over the last 25 years. Its popularity arises from dissatisfaction with functional, disjointed, and parochial management approaches. IEM differs from traditional resource management in several ways. IEM emphasizes the need for comprehensive strategic management. It also demands interaction and coordination among stakeholders. IEM considers all connections in the environment and stresses proactive consideration of the environment. The Wisconsin Department of Natural Resources (WDNR) recently reorganized with a new emphasis on environmental resource management. As part of this new emphasis, WDNR is facilitating watershed management in the Upper Sugar River watershed in Dane County, Wisconsin. The effort, termed the *Upper Sugar River watershed initiative* (USRWI), is nearing completion of the initial planning phase. This paper reviews the tenets of IEM; examines the extent to which management efforts have been integrated in USRWI, and analyzes whether or not the steps taken during the planning process have built a framework that will lead to successful plan implementation. Modifications that may improve the plan are also prescribed.

1. Literature review

Integrated environmental management (IEM) is an important method of resource management that may be superior to past functional approaches to management. IEM is growing in popularity in the resource management field. For example, the new focus of the United States Environmental Protection

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Agency (EPA) is management at the ecosystem level. IEM is also behind the recent reorganization of the Wisconsin Department of Natural Resources (WDNR) which is intended to facilitate management at the ecosystem watershed level. Australia's catchment (i.e., watershed) management (Margerum 1995) also is based on IEM. Because IEM is in its infancy, no one definition has been accepted. IEM has been defined as:

- A strategic process of interactive decision making that requires participants to take a comprehensive and interconnected view of the environment, identify common goals, strategically narrow the action areas to key issues or problems, and coordinate decision making. (Born and Margerum 1993, p. 53)
- Proactive or preventive measures that maintain the environment in good condition for a variety of long-range sustainable uses. ...[IEM includes] coordinated control, direction, or influence of all human activities in a defined environmental system to achieve and balance the broadest possible range of short and long-term objectives. (Cairns 1991, p. 5)
- A holistic approach that considers the array of interconnections among the biophysical, social, and economic systems. It is goal-oriented and strategic, using collaboration among a wide range of stakeholders and consultation with the public. (Margerum 1996, Executive Summary)

Extensive experimentation with this new approach to land and water resource management began in the 1970s in response to the lack of success of a more functional approach (Born and Nakamura 1993; Born and Margerum 1993). The functional approach to resource management has been largely reactive and disjointed and has focused on narrow or limited purposes (Born and Sonzogni 1995). Easter and Dixon (1986) state that although some gaps in the physical and biological sciences exist, the main gap in environmental management is institutional. IEM is an attempt to close that gap. For Easter and Dixon (1986, p. 4) the most difficult task is:

To interpret and apply the biophysical information to questions dealing with overall project planning and implementation. For successful project implementation...institutional considerations are paramount.

Cairns (1991, p. 6) believes that the problem is institutional not methodological:

Typically, lack of methodology is not what impedes more effective use of natural systems...but rather many institutions...fail to integrate system management responsibilities.

A close examination of these definitions shows the distinctions between IEM and the more functional management approach. These characterizations of IEM highlight several themes. The first theme is that IEM involves comprehensive or inclusive analysis. *Comprehensive-inclusive analysis* refers to the requirement that managers complete a broad environmental scan of the

problems/issues.⁴ Unlike functional management that may focus on watershed management primarily from a flood control perspective, for example, IEM includes all factors in the decision-making process. Factors to be considered include natural and ecological resources, the regional economic structure, and institutional arrangements. Born and Sonzogni (1995, p. 170) summarize the comprehensive-inclusive theme:

IEM must embrace all the critical biophysical, chemical, and human parts of an ecological system; all the significant potential uses and objectives for the system; and all the entities—public and private—that affect or can be affected by management.

A second theme in the literature is that IEM considers all connections in the environment. Managers must consider how ecological, sociopolitical, and institutional factors both affect and depend on each other. Internal linkages within these factors also must be examined. Born and Sonzogni (1995, p. 170) explain that the

Interconnective dimension of IEM specifically addresses interrelationships and linkages—among physical, chemical, and biological processes and components; among multiple, cross-cutting, and often conflicting resource uses; among the many entities that collectively comprise the community of interest.

A common example of the need to consider interconnections is land use impact on water quality. Tons of topsoil erode into our waterways as a result of irresponsible land stewardship. If land were managed more responsibly, increased water quality would result.

A third theme of IEM is a strategic planning-management approach. This approach, borrowed from the business world, realizes the impossibility of attacking all issues and considering all connections in every decision. The IEM approach is not incompatible with a comprehensive approach, as observed by Born and Sonzogni (1995) and Born and Margerum (1993). IEM focuses management on the most critical issues. IEM is a dual approach. First, all factors are identified and examined. Second, factors are prioritized, and the focus is put on the most critical issues to achieve the greatest impact using limited resources.

A fourth theme of IEM is proactive or preventative management. A criticism of traditional management is that it is too reactive. Reactive management has two shortfalls. Often the effects of a crisis are so severe that the ecosystem is beyond repair. When repairs can be made, rehabilitation costs may be higher relative to preventive management costs. IEM attempts to avoid these problems.

Finally, IEM uses an interactive-coordinated approach. Because of the diversity of views and dispersed nature of information in a regional ecosystem,

⁴ *Environment* in this context refers not solely to the natural environment but to all factors affecting behavior and outcomes.

interaction between all stakeholders is of paramount importance. The rationale behind involving all stakeholders is three-fold. First, everyone is included in order to identify and examine all issues from the beginning. If a stakeholder not involved in the planning process later identifies a major problem in the plan, implementation may be fruitless because a critical factor is not addressed. Second, stakeholder groups not involved in the planning process can threaten successful implementation if such groups come forward during the implementation phase and condemn the process for not considering their concerns. To avoid a situation in which a powerful stakeholder group slows or prevents implementation, its views must be considered during the planning process. Finally, Margerum (1996) points out that by including stakeholders in both the planning and implementation phases of IEM, implementation will be easier. Persons or groups included from the beginning have a better understanding of the plan, are more apt to cooperate with one another, and are more passionate about implementation.

The rationale for stakeholder involvement characterizes the coordination component in IEM. Born and Sonzogni (1995) define coordination as

A process of informed negotiation and bargaining, an exchange of resources among parties of interest, to achieve mutually desired objectives. It involves elements of: (1) information exchange and (2) conflict resolution (p. 172).

All actors must be involved from the beginning, voice all relevant issues, compromise and form agreement about the focus, and implement strategies that address these concerns.

This brief introduction to IEM highlights some of the benefits of the approach. A comprehensive review of these advantages appears in Cairns and Crawford (1991); several are listed here:

- Long-term protection of the environment;
- Reduced financial and environmental costs due to preventive management;
- Increased cost effectiveness resulting from a focus on the most critical issues

Despite these advantages, IEM has not materialized as a widely used resource management method. Lack of stakeholder involvement, the inability of those involved to assume a future focus, and difficulties in positively influencing institutions are several obstacles to IEM implementation. Other difficulties are elaborated in Easter and Dixon (1986) and Clark and Minta (1994). The following Upper Sugar River watershed initiative case study (USRWI) reveals some of the impediments to IEM.

2. Methods

This case study was conducted by examining the literature concerning USRWI (e.g., historical documents, meeting minutes, the draft plan) and through a series of personal, telephone, and email interviews with members of the coordinating committee, the body responsible for the action plan. We compare USRWI's IEM attempts to a theoretical IEM approach. Our analysis of the USRWI plan uses a framework that identifies 20 elements essential in goal attainment. The framework was developed by Dr. Richard Margerum based on eight case studies of IEM in the United States and revised based on research of Australian cases. Margerum (1996) states that these are

Critical elements...that appear to contribute to success.... Success refers to achievements such as resolution of conflicts, improvement in management processes, increased cooperation, new initiatives, and satisfaction among participants (Executive Summary).

Margerum (1996) adds the caveat that this framework is not a recipe for success but a compilation of factors that contribute to it. Additionally, none of the cases upon which this framework is based were mature enough to evaluate environmental outcomes such as improved water quality.

Two similar difficulties in analyzing whether USRWI has developed a strong framework for implementation are present in the forthcoming analysis. First, IEM is a developing management approach, and no completed case exists to which USRWI can be compared. Second, analysis of the success of USRWI is premature. There are no outcomes to analyze; moreover, the planning process is not complete. Many changes could occur that would alter my conclusions. Despite these two drawbacks, I believe this analysis will shed light on some strategies that will facilitate successful IEM.

3. The Upper Sugar River watershed

3.1 Watershed characteristics

The Upper Sugar River watershed, located in southwestern Dane County, Wisconsin, has a drainage area of approximately 65,500 acres or 102.3 square miles. The river begins in the moraines at the eastern edge of Wisconsin's driftless area, then meanders through a broad flat flood plain before arriving at the Lake Belle View impoundment on the southern edge of the county. The Upper Sugar River and/or its tributaries travel through seven towns, two villages, and the cities of Fitchburg, Verona, and Madison, the state capital. The Upper Sugar River is a dominantly spring-fed system with riparian wetlands, possessing the most diverse fishery in southern Wisconsin. The river system has good water quality, with dissolved oxygen concentrations adequate to support a cold water

fishery in certain stretches. It also provides recreation, wildlife habitat, flood protection, and aesthetics (USRWI 1997).

3.2 Threats to the Upper Sugar River

The Upper Sugar River and its tributaries have been affected by past urban and rural activities, as indicated by large amounts of silt and by significant channelization and lateral ditching. The river system is threatened by stream bank erosion caused by streamside grazing and by runoff from farmland, streets, parking lots, and construction sites.

The threats to the Upper Sugar River system can be generalized as: (1) water quality issues, and (2) water quantity issues. Water quality can be separated into urban and rural categories. When urbanization occurs in a watershed, water quality in streams and rivers is affected. It is projected that southwest Madison and Verona will experience rapid growth over the next 20 years (Dane County Regional Planning Commission 1997). Badger Mill Creek, a main tributary of the Upper Sugar River, drains much of southwest Madison and almost all of Verona. During the 1970s violations of water quality standards due to poorly treated wastewater were common, and the creek only supported pollution-tolerant species. Subsequent changes in wastewater discharge have increased water quality and have led WDNR to reclassify the stream from a limited forage fishery to a warm water forage fishery. This improvement, however, is threatened by encroaching development. According to USRWI (1997):

Construction site erosion and urban development (e.g., streets and parking lots) in the watershed are probably the most serious threats due to reduced ground cover and significant increases in sediment-laden stormwater runoff. Transition from undeveloped to developed areas during construction also presents one of the most severe cases of sediment delivery and loading to streams. Poor or non-existent construction site erosion control and stormwater management threatens water quality... (p. 4)

The rural impacts on water quality also include developmental issues associated mainly with rural subdivisions; however, the primary rural concerns are with agricultural practices. The entire western and northern portions of the watershed are unglaciated with some woodlands. Farms are located next to creeks and in stream valleys and river bottoms. This is typical of how the area originally was developed—farms were located near water for livestock and household purposes. The placement of farms and the relief of the land make animal waste and inorganic chemical runoff, streamside grazing, and soil erosion the principal rural concerns (USRWI 1997).

Water quantity concerns for the Upper Sugar River system originate mainly in urban areas. Excessive groundwater diversion threatens to decrease ground-

water levels and base flows in the Upper Sugar River system and associated wetlands. Groundwater diversion is occurring in the watershed as a result of municipal well water withdrawals and increased impervious material. Municipal withdrawals lower the water table and, therefore, decrease groundwater seepage into creeks and rivers. Increased impervious materials also lower the water table by decreasing rainwater infiltration into the groundwater, i.e., groundwater recharge. Decreased water quantity issues are evident in Badger Mill Creek, where base flow has been decreased as much as 50 percent (USRWI 1997).

A second water quantity threat, directly related to the increase in impervious materials, is flooding. According to USRWI (1997): "Urbanization in the Upper Sugar River watershed results in more concrete, increased runoff, decreased infiltration, higher peak floods and flash flows" (p. 7). Flooding is already a problem in the downstream areas of the Upper Sugar River and Badger Mill Creek and is the main concern of riparian farmers.

3.3 Historical efforts

Past threats to the Upper Sugar River system have prompted several conservation efforts by governments, private organizations, and individual citizens. The Watershed Protection and Flood Prevention Act, the Upper Sugar River Watershed Association, and the Madison Metropolitan Sewerage District facilitated three major efforts.

3.4 Watershed Protection and Flood Prevention Act

The most significant conservation effort was prompted by the federal Watershed Protection and Flood Prevention Act, Public Law 83-566 (P.L. 566). The law provided cost-sharing funds for waterway management. Federal money was provided in 1981 after the Dane County Land Conservation Department (DCLCD) [formerly the Dane County Soil and Water Conservation District and the Dane County Soil and Water Conservation Committee (DCLCC)], the United States Department of Agriculture Natural Resources Conservation Service (formerly the Soil Conservation Service), and the State of Wisconsin agreed to sponsor planning and management efforts in the Upper Sugar River watershed (Dane County Soil and Water Conservation Committee 1981).

The first step in managing the watershed, taken by DCLCD, was to establish the Upper Sugar River Watershed Plan, which focused on reducing nonpoint sediment pollution (Dane County Land Conservation Committee 1990). The three main objectives of the Upper Sugar River Watershed Plan were to protect six miles of streambank from livestock grazing, to reduce the amount of animal waste reaching streams by installing livestock waste management systems on 52 sites identified as having a significantly adverse impact on water

quality and to decrease soil erosion on 13,320 acres through conservation measures. The costs of these objectives were estimated at \$1,640,150, of which \$1,130,280 would come from P.L. 566 funds and \$509,870 from other sources. The plan was to be implemented over 13 years.

From 1981 to 1990 major soil conservation and water quality protection measures were applied, including conservation tillage, contour farming, grassed waterways, livestock waste management systems, and streambank fencing. According to DCLCC (1990),

These efforts resulted in improved water quality in some reaches of area streams and tributaries, a significant reduction in soil erosion from area fields, and better management of barnyard livestock waste (Executive Summary).

The total costs were much less than the original estimate, only \$227,473 (\$136,427 from P.L. 566 funds and \$91,046 from other sources) (DCLCC 1990).

The main factor responsible for the significant decrease in costs was volunteer labor. According to DCLCC (1990):

This support came from a coalition of concerned citizen organizations and wildlife and fishing groups. They encouraged farmer participation by creating a positive atmosphere about conservation and stepped in with vital volunteer assistance...(p. 2).

Volunteers included members of the Young Adults Conservation Corps, the Dane County Conservation League, Trout Unlimited, and students from Madison area public schools.

The objective to protect six miles of streambank from grazing was successful. DCLCC (1990) states:

In 1990 streambank grazing was causing degraded water quality on 2.5 miles of streambank. Comparing this figure to the over eight miles of streambank impacting water quality in 1979, the fencing and grazing restrictions appear to be working (p. 7).

The objective to decrease soil erosion on 13,320 acres of cropland was also met with a high degree of success. Sediment yield was reduced on 26,398 acres of cropland, an improvement almost double the desired goal. Potential sheet and rill erosion was reduced 65 percent, from 270,789 tons of soil annually to 94,421 tons (DCLCC 1990).

The effort to reduce animal waste runoff into streams was a mix of success and failure. The effort was successful in that the amount of oxygen-demanding organic matter reaching streams was reduced from 43,000 tons annually to 12,000 tons (DCLCC 1990). But only 26 of the 52 planned waste management systems were installed, and in 1990 34 sites continued to be identified as having a significantly adverse impact. Of the eight most critical sites, two are still major polluters.

Table 1. Summary of objectives and outcomes

Planned Objectives	Improvements Installed	Outcome
<ul style="list-style-type: none"> • Protect six miles of stream-bank from livestock grazing 	<ul style="list-style-type: none"> • Over six miles of stream-bank fencing 	<ul style="list-style-type: none"> • Streambank grazing decreased 75 percent
<ul style="list-style-type: none"> • Reduce the amount of animal waste reaching streams by installing 52 waste management systems on sites identified as having a significant adverse impact on water quality 	<ul style="list-style-type: none"> • 26 waste management systems 	<ul style="list-style-type: none"> • Oxygen-demanding organic matter reaching streams decreased 70 percent annually from 43,000 tons to 12,000 tons • 34 sites continue to be identified as having a significant adverse impact on water quality
<ul style="list-style-type: none"> • Reduce soil erosion on 13,320 acres of cropland by promoting and providing assistance in installation of conservation measures 	<ul style="list-style-type: none"> • Conservation tillage • Contour farming • Grassed waterways 	<ul style="list-style-type: none"> • Sediment yield reduced on 26,398 acres of cropland • Sheet and rill erosion reduced 65 percent from 270,789 tons to 94,421

A summary of the plan and outcomes of implementation is presented in Table 1.

Why were some of these goals achieved? Why were other goals not achieved? Did the goals lead to increased water quality? One reason several of the goals were attained was volunteerism. A second reason for success was cost sharing. Waste management systems were financed partially through grant money, and the farmer paid for the remainder of the costs. Farmers also had an economic incentive to install systems because captured manure decreases fertilization costs. Despite the economic and cost-sharing incentives, only half of the farmers approached participated.

Follow-up testing in 1990 revealed that overall water quality had decreased somewhat. DCLCC (1990), however, cautions that these numbers may not be realistic because sampling science is in its infancy and drought conditions in the late 1980s may have had a short-term detrimental impact on water quality. Moreover, the potential long-term impact of efforts has yet to be realized. Regardless of the impact of the 1980s efforts, it is clear that a gap in management remained in 1995 when USRWI was started in a watershed that was listed as part of Wisconsin's Nonpoint Source Water Pollution Abatement Program.⁵ Water quality was a concern; the 1980s efforts had not completely

⁵ Wisconsin's Nonpoint Source Water Pollution Abatement Program was created in 1978 by the state legislature. The goal of the program is to improve and protect the water quality of streams,

remedied the situation, and water quantity and preventive management issues, which had not been addressed under P.L. 566, were concerns.

3.5 The Upper Sugar River Watershed Association

A second historical management effort involved the Upper Sugar River Watershed Association (USRWA). USRWA was a grassroots organization that relied entirely upon participation of the local citizenry. The association formed in the mid-1970s after a series of reactionary meetings addressing primarily the problem of increased flooding. USRWA focused on communication and awareness building. Its main objectives were to publicize watershed issues and to provide a forum in which these issues could be addressed. USRWA did not undertake any hands-on restoration projects or attempt to influence institutional arrangements. It tried to avoid contentious issues.

USRWA was successful in forming an effective information and education (I and E) forum. Many signs reading "Welcome to the Sugar River Watershed" were erected. According to a past leader of the association, there was widespread participation: (1) 400 to 500 persons would attend biennial summer and winter picnics, and (2) representatives from most governments in the watershed regularly attended the association's monthly meetings.

The lifespan of the USRWA was only ten years. A past leader identified two reasons for the organization's demise. First, people began to see the fruits of their efforts, and their satisfaction translated into inactivity. The crisis around which the group formed was being addressed by DCLCD and watershed issues appeared to have risen to the forefront.

Second, the association suffered from a lack of sustained leadership. The association had four presidents who successfully facilitated meetings, picnics, and I and E efforts. But no other volunteers were found to replace these leaders.

3.6 Madison Metropolitan Sewerage District

A third historical and current management effort is the return of highly treated effluent to Badger Mill Creek from the Madison Metropolitan Sewerage District (MMSD). In 1978, prompted by repeated water quality violations and the fact that it was more cost effective to treat its wastewater at MMSD Nine Springs facility, the City of Verona closed its wastewater treatment plant and became part of MMSD. The treatment of Verona's wastewater, which originates

lakes, wetlands, and groundwater by reducing pollutants from urban and rural non-point sources. The Wisconsin Department of Natural Resources and Department of Agriculture, Trade, and Consumer Protection administers it. The program focuses on protecting and rehabilitating the most sensitive and degraded systems.

in the Sugar River Basin at a facility that discharges into the Yahara River Basin, constitutes an interbasin transfer that offsets the regional water equilibrium. The MMSD Board of Commissioners and the general public were concerned about this water balance issue and formulated and implemented a strategy to return highly treated effluent to the Sugar River Basin.

Despite costs of \$5.7 million and strong opposition at times, MMSD was successful in obtaining the goal of effluent return for several reasons: (1) MMSD has no elected officials so political pressure is minimal, (2) MMSD has authority to enforce its decisions, and (3) MMSD possesses financing mechanisms. MMSD also caters to the needs of the public and has built a strong coalition of support. For example, MMSD convened a citizens advisory committee to discuss how effluent return should be accomplished. Some public concerns were addressed by constructing an aesthetically pleasing setting where effluent return will occur.⁶

These management efforts in the Upper Sugar River watershed provide several valuable lessons for watershed planners and managers. First, all three efforts clearly defined goals and objectives. Second, success was due to strong community support and volunteerism. Third, enforcement authority, steady financing mechanisms, and freedom from political pressure make management less difficult. Fourth, despite incentives and a relatively successful I and E campaign, achieving widespread voluntary participation in watershed management practices is difficult. Finally, lack of a crisis situation and/or strong leadership complicates management efforts.

4. The Upper Sugar River watershed initiative

4.1 Is this integrated environmental management?

USRWI is an attempt by WDNR to manage natural resources using an IEM approach. USRWI is near the end of the planning phase and soon will attempt implementation of the prepared plan.⁷ The goal of this discussion and analysis is to describe USRWI, discuss the extent to which environmental management has been integrated, and analyze whether the planning phase will provide the framework for successful implementation.

4.2 Genesis of USRWI

USRWI is a cooperative effort facilitated by WDNR involving various governmental and nongovernmental organizations. The effort began in September

⁶ MMSD has constructed a series of small waterfalls and rapids from artificial rocks.

⁷ The plan is not yet in its final form, but stakeholders in the watershed are currently reviewing a draft plan.

1995 when WDNR received a 104(B)(3) grant under the Clean Water Act from United States Environmental Protection Agency.⁸ WDNR also received 104(B)(3) grants for two other watersheds in Wisconsin. The three separate approaches are to serve as experiments to help determine the optimal techniques for achieving effective natural resource management. WDNR's current experimentation with IEM was preceded by several changes that influenced reception of these grants. First, EPA was evolving toward an ecosystem approach. Second, WDNR was reorganizing into geographical management units (GMUs) which are watershed- rather than political boundary-based.

The Upper Sugar River watershed was chosen as one of the three pilot projects for three reasons. First, water resource concerns needed to be addressed. Second, WDNR wanted to try IEM in a watershed with diverse interests, numerous stakeholders, and opportunities to proactively manage resources. Finally, this watershed was a priority watershed under Wisconsin's Nonpoint Source Water Pollution Abatement Program.⁹ USRWI was to be a stepping-stone to a purportedly more intensive, steadily financed watershed management program that was better equipped to complete implementation.

4.3 Grant appropriation

WDNR contracted with several governmental and nongovernmental entities to execute the project. The grant amount was approximately \$250,000 and was appropriated roughly as: (1) Dane County Regional Planning Commission (RPC), \$40,000; (2) Dane County Land Conservation Department, \$15,000; (3) University of Wisconsin—Extension (UWEX), \$5,000; (4) \$40,000 for other governments; and (5) WDNR, \$150,000. The contract with RPC was for a staff-person to provide WDNR with planning assistance. The Dane County Land Conservation Department's allocation was to be used to: (1) hire a limited term employee to undertake I and E objectives, and (2) develop a phosphorous and sediment loading budget for the Upper Sugar River. UWEX was contracted to facilitate development of a curriculum in area school districts that would involve groups of students physically working in or near streams or rivers in the watershed. Contracting with other governments has been limited to cost-sharing money with the City of Madison for a feasibility study of a stormwater management district. Funds allocated to WDNR are for staff and other resources for the management effort.

⁸ The grant was for two years, but because excess funds remained at the end of this period it has since been extended through the end of 1998.

⁹ Because the resources of the Nonpoint Source Water Pollution Abatement Program have recently been reallocated, the Upper Sugar River is no longer listed as a priority watershed. Currently, plans are to reapply for this status in June 1998.

4.4 The planning process

The planning process began with several public meetings in early 1996. The meetings were to provide a forum in which stakeholders could determine what needed to be accomplished in the watershed. The first meeting was partially successful in attracting stakeholders (about 100 persons). Representatives from all general purpose governments in the watershed, several school districts, UWEX, UW-Madison, several development associations, and conservation groups attended; however, few general citizens were present. Most persons were paid staff from government or other organizations that wanted to at least acknowledge the new initiative. This token involvement is especially evident considering the dramatic decrease in attendance (10 to 20 persons, mostly government officials) at later general meetings.

Including all major stakeholders is essential in the planning process. USRWI has tried fruitlessly to foster increased stakeholder involvement. Sparse participation means that few views have been considered in the planning phase. Discussion between ten persons hardly constitutes widespread interaction in a 100 plus square mile watershed that includes a large metropolitan area.

Lack of extensive stakeholder involvement suggests lack of a comprehensive analysis. Although most interviewees agreed that analysis was inclusive, most had the same governmental-political orientation. Several coordinating committee members admitted there was a lack of an agricultural and development perspective at most meetings.

Following several meetings, the few participants agreed to some general areas of concern in the watershed. WDNR and RPC staffpersons examined these areas of concern, generalized them into three categories, and formed workgroups to address the issues. The coordination of these workgroups and facilitation of the initiative is the responsibility of a staffperson from RPC and WDNR (herein referred to as *the staff*). Workgroups include the water quality-quantity workgroup, which is to consider effects of sedimentation, development, and treated effluent return from MMSD. The habitat and recreational uses workgroup considers various in-stream improvement projects that would restore or enhance habitat and increase recreational opportunities. Both of these groups report to the third workgroup, the coordinating committee. The coordinating committee was formed to organize and lead the effort, create a workable action plan, and facilitate implementation. Officially, the duties of the coordinating committee are:

To develop a workable institutional framework, find innovative ways to overcome implementation barriers, fund and implement activities, and promote local public awareness, project coordination and citizen involvement needed to support this effort (USRWI 1997, p. 2).

A summary of the workgroup framework is presented in Figure 1.

The workgroup framework has not only been designed to address issues ranging from sedimentation to canoeing, but to also consider the interconnections in the watershed. For example, the interconnections between development (impervious areas), groundwater recharge, and surface water flows have been addressed in the draft plan. Land use characteristics and their effect on water quality and quantity have been a major focus of USRWI. Finally, the intergovernmental and cross-cutting relationships have been recognized as a major implementation obstacle and are to be handled by the coordinating committee in the upcoming implementation phase.

Two critical economic elements have, however, been overlooked. First, there has not been any serious consideration of the costs involved in implementing proposals outlined in the draft plan. The high infrastructure and transaction costs associated with certain objectives may mean they stand little chance of being implemented by governments that have less expensive priorities. The oversight of the connection between cost and willingness and ability to implement may prove detrimental to implementation. Second, increased development costs associated with higher restrictions and more exactions will increase prices in an already expensive housing market. The costs

Figure 1. Workgroup framework

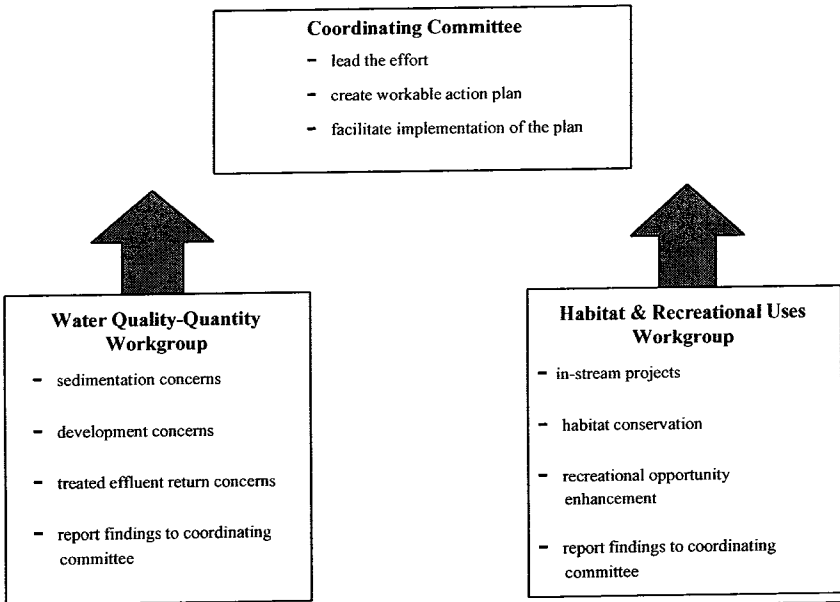


Table 2. Summary of concerns and recommendations

Concern	Recommendation
<ul style="list-style-type: none"> • Lack of citizen involvement which is critical to plan implementation 	<ul style="list-style-type: none"> • Promote volunteerism through I and E campaign and cost-sharing strategies
<ul style="list-style-type: none"> • Institutional barriers could prevent implementation 	<ul style="list-style-type: none"> • Negotiate a workable governmental framework such as memo of understanding
<ul style="list-style-type: none"> • Phosphorous and sediment loading • Flooding 	<ul style="list-style-type: none"> • Create stormwater management plans • Implement agricultural best management practices • Promote development that preserves the greatest amount of pervious areas
<ul style="list-style-type: none"> • Lack of funding for stormwater management 	<ul style="list-style-type: none"> • Achieve economies of scale through creation of a stormwater management district
<ul style="list-style-type: none"> • Currently ineffective erosion and sediment control ordinances 	<ul style="list-style-type: none"> • Upgrade urban construction site erosion control ordinances to be consistent with the Dane County erosion control ordinance • Enhance enforcement of ordinances
<ul style="list-style-type: none"> • Degraded habitat and recreational resources 	<ul style="list-style-type: none"> • Develop a habitat improvement strategy for Badger Mill Creek including provision for brush removal, planting of desirable shoreline grasses, and structural habitat improvements such as rip-rap

of land dedication for a detention pond, for example, will be passed to the consumer rather than being absorbed by the developer.

Next, the coordinating committee developed overall goals and a mission statement. Two general goals were: (1) to increase public awareness of the water resources in the watershed, and (2) to develop an action plan outlining both short- and long-range activities. The following mission statement was established:

The public places high values on the waters of the state, the life they support and the uses they provide. The Sugar River Initiative will build partnerships in promoting the restoration, protection and enhancement of the water resources in the watershed for the continued use and enjoyment by the public. (USRWI 1997, p. 2)

The coordinating committee then met monthly over a period of 1.5 years. Information from these meetings was used to create a draft plan. The plan describes concerns within the watershed, makes general recommendations

addressing these concerns, and provides rationales for prescriptions. Table 2 summarizes concerns and recommendations identified in the plan.

Concerns in the table have been prioritized, with stormwater runoff the most important issue. Several coordinating committee members do not agree with the current prioritization. To address stormwater runoff in the urbanizing headwaters will require intergovernmental agreements that will take years to coordinate. Some members believe small hands-on projects should be the main focus in the short term. They claim achieving small successes will lead to coalition building and citizen-based political pressure. The staff also has emphasized this stepping-stone approach, but the focus has been long-term goals. Few substantive actions have been taken during the planning phase.

If members of the committee that formulated the plan do not agree with some parts of it, then whose plan is this? To answer this question, several others must be considered: (1) Who comprises the coordinating committee? (2) How much was the committee involved in the planning process? and (3) How was the plan formulated? The committee is made of 13 members representing the City of Madison, City of Verona, Village of Belleville, Towns of Cross Plains and Verona, DCLCD, MMSD, the Izaak Walton League, UWEX, RPC, and WDNR. One city, one village, five towns, and numerous other stakeholder groups are not represented on the committee.

Poor attendance at coordinating committee meetings is a concern. Attendance has dropped dramatically since the beginning of the planning process. Most meetings in the last nine months have only been attended by five or six members (two being staff). Although staff is supposed to only facilitate meetings, most members consider staff to be committee leaders. The perceived leadership role and the fact that the staff is the only stabilizing factor that at any one time knows the status of USRWI almost guarantee that their (sic) views have had a major influence.

Staff influence is especially evident considering they (sic) wrote the draft plan based on their (sic) interpretations of meeting minutes. Staffers are employed by influential, opinionated agencies. The question remains: Is this a grassroots plan incorporating a wide array of stakeholder views, a local government plan, or a top-down agency plan?

USRWI realizes the need to focus on the preventative aspect of management prescribed in IEM, while at the same time completing restorative projects. Hands-on projects are unlikely to be proactive. For example, several objectives in the draft plan are wetland restoration and construction of an Upper Sugar River water-based trail. These support building endeavors are complemented with proactive plans intended to prevent further degradation of the watershed. The proactive approach is articulated in the draft plan. USRWI (1997) states:

Generally, a problem has to become a crisis before anyone notices. On the other hand, it is much easier and less expensive to fix the problem before it happens than after it is too late (p. 8).

The proactive approach is exemplified by USRWI's focus on comprehensive stormwater management. USRWI leaders realized that much development is planned for Verona and southwest Madison. Stormwater planning and management should occur before development begins. The draft plan reads:

As development proceeds, opportunities to attenuate and treat stormflows will decrease as land prices increase. In particular, the City of Madison needs to move ahead in the next year or so before strategic opportunities to address urban stormwater are lost.... Suitable areas for large detention/retention facilities need to be identified and possibly acquired before development occurs. (USRWI 1997, pp. 9-10)

USRWI has been moderately successful in its IEM approach. Unsuccessful efforts have been made to include all stakeholders in the planning process. Intergovernmental cooperation has not occurred. The interactive-coordinative component has been addressed with limited success. Although all coordinating members believe USRWI completed a broad survey of the issues, this is the opinion of only a few residents of a watershed that spans half of Dane County. Lack of stakeholder involvement means the planning process is not inclusive. Strategic issues appear to have been prioritized, but with whose priorities? Some interconnection issues have been addressed (e.g., land-water connection, groundwater recharge-surface water flows), while other critical economic interconnections have been overlooked. Finally, preventive-proactive measures have been partially addressed in the draft plan. USRWI is moving toward IEM, but has a long way to travel.

4.5 Prospects for implementation

The final step in IEM is putting the plan to work. According to Margerum (1996):

Stakeholder groups are coming together, developing a new collective understanding of complex problems, and reaching consensus on plans of action. However, these groups are struggling to implement plans (pp. 1-2).

Nemke (1997) adds:

While theories of how problems should be attacked on a watershed basis have become more well defined, the mechanisms for implementation remain extremely weak (memorandum).

USRWI is nearing a crossroads. USRWI must overcome several barriers to implementation: poor management decisions and weaknesses inherent in IEM.

4.6 Institutional and organizational barriers

The most difficult obstacles to overcome in IEM are institutional and organizational factors. *Institutions* include the rules and rights that define people's relationships to resources. *Organizations* are ordered groups of people such as family farms, firms, and government agencies (Easter and Dixon 1986). In the Upper Sugar River watershed, institutions are disjointed. Many organizations are either ignorant of, or disinterested in, USRWI or organizations have other priorities more pressing than watershed management.

Few farmers, developers, general citizens, and less than half of the governments have participated in the planning process. The plan relies heavily on these stakeholders voluntarily complying with the plan. Without widespread participation, it is unlikely that goals will be achieved. Several coordinating committee members believe that lack of participation by a single influential actor in the watershed could spell disaster for the whole project.

There are several reasons for the widespread ignorance and disinterest. First, staffers admit that more could have been done to attract stakeholders to the planning process. Correspondence with past participants and minimal press coverage have been inadequate. Contact with stakeholders must significantly increase to facilitate broader participation.

Second, committee meetings were often uninteresting. Meetings consisted of discussions of long-range goals and the planning process. Few conversations concerned on-the-ground projects.

Finally, there is a lack of communication between coordinating committee members and their constituencies. Committee members are supposed to gather information from the people they represent, report findings at committee meetings, and relay information to their constituencies (i.e., they are supposed to be representatives). Due to the lack of communication, most of the public and governments have not realized the large role they are expected to play in implementing the prepared plan.

Some governments, however, are enthusiastic about watershed management. Verona and Madison have taken steps to protect and enhance the river system.¹⁰ Several committee members believe the governments they represent would be willing to sign some form of a nonbinding agreement that would recognize USRWI's advisory role in decision making.

Enthusiasm by Verona and Madison is encouraging, but the key word in the last statement, nonbinding, alludes to one of the biggest problems inherent in IEM—lack of authority. USRWI has no power to enforce implementation or

¹⁰ Verona has voluntarily installed rip-rap in Badger Mill Creek, and Madison has begun studying feasibility of a comprehensive stormwater management plan (although this probably would not have been started without cost-sharing money from the 104(B)(3) grant).

raise funding. Moreover, there are several impediments in the Upper Sugar River watershed that inhibit the high level of voluntary government action necessary to achieve plan goals.

First, governments are good at spending someone else's money, but they are frugal with their own funds. For example, Madison had shown interest in completing a stormwater management plan feasibility study for some time, but was not able to find \$40,000 in the budget. When USRWI offered a 50-50 cost share, the wheel started turning. Additionally, during the beginning of the planning process, governments were much more interested in the project. As the amount of grant money available was diminished, as the watershed was taken off the priority watershed list, and as uncertainty increased about a second EPA grant, governmental interest dwindled.¹¹

Second, budgets are limited. If there were enough money, everything could be accomplished. Committee members supported watershed management, but were unwilling to sacrifice more visible services to fund watershed management. Governments have priorities such as sewer, roads, and snow removal. Watershed management is more difficult for the public to perceive than are patched potholes. Several members stated: "We're (the members' governments) all for watershed management, but when the rubber hits the road, we've got better things to do." During the planning phase, watershed management has not been promoted to priority status in the minds of individual citizens and government budgets. The optimal framework for IEM implementation, therefore, does not exist.

A third impediment to voluntary action is that governments, organizations, and individual citizens want to get \$1 of benefit for every \$1 they spend. Madison, for example, is not willing to give \$100,000 to a regional organization and have only \$50,000 of that amount spent within the city. This equity issue also appeared when some committee members replied to an interview question by replying: "Why should my government spend money when other governments are not funding projects?" Unwillingness to cooperate could be a significant impediment to implementation.

A final institutional obstacle is the non-uniform management within the watershed. One example is construction site erosion control ordinances. The county has mandated a certain level of sediment that is allowed to erode from construction sites in the unincorporated areas of the county. Urban areas, however, can adhere to less stringent regulations.

¹¹ A second 104(B)(3) grant in the amount of \$300,000 was recently received for the period between October 1, 1997 to September 30, 1999.

4.7 Lack of local citizen participation as a barrier

Local citizen participation has been separated from other organizational barriers because of the hypothesized main factor that stimulates citizen involvement: action.¹² Volunteer citizen participation is critical to successful plan implementation. Strong community support, facilitated through action-oriented hands-on projects, was essential to P.L. 566 efforts in the 1980s. Yet, as aforementioned, citizen participation has been deficient. Involvement has lacked for many of the same reasons governments have not become involved, but citizen desire for action over planning appears the prevalent cause (e.g., lack of awareness, other priorities).

USRWI has tried to spark citizen participation through an I and E campaign that has included a hike, bus tour, and development of a high school curriculum involving the watershed. There has been no focus on actions such as streambank fencing, brush removal, trash clean-up, and lunger structure installation. Discussing the role of WDNR in watershed management, Nemke (1997) states:

They seem to be more concerned with validating the decision making process than using good science to evaluate and solve real problems. Much of the money allocated for watershed activities seems to have gone for staff support (memorandum).

Nemke was referring to WDNR watershed management, but he characterizes many of the efforts of USRWI. Too many resources were devoted to decision-making compared to on-the-ground actions. The lack of an action orientation has limited citizen participation.

Possibly one of the reasons that a majority of resources were devoted to planning was the allocation of grant money. Over half of the grant was appropriated for two .33 FTE staff for planning over a two-year period. More funding was needed for hands-on projects during the planning process.

4.8 Administrative barriers

Are there other administrative decisions that are impeding the plan? The WDNR staffperson was trained as a cartographer and is now a water specialist with no planning background. The RPC employee says that the staff had no strategic plan and that it has often been difficult to identify what the next step should be. He attributes the lack of direction to unfamiliarity with the ecosystem management concept. Staff identified USRWI as a new approach to natural resource management but were unaware of some of the concepts involved.

¹² This is not to say action does not play a role in the decision of a government to get involved, but it appears an especially important factor in attracting individual citizens to play a part.

Administrative decisions to include a non-planner agency person and a planner inexperienced in IEM have increased the road blocks to success.

Second, a limited-term employee (LTE) was responsible for the I and E campaign. She was a great communicator and had good rapport with local citizens. She facilitated two major efforts, a hike and bus tour. Just as she was becoming knowledgeable about the watershed, she found a full-time job with benefits. Should an endeavor as important as I and E (considered the most important effort to successful implementation by some) be the responsibility of an LTE or of a full-time employee?

One staff complaint is that facilitating USRWI is a full-time job, but currently USRWI has only part-time help. Another complaint is that there is no champion to lead the efforts. No government official or other citizen has been the leader. The effort may have to be agency-led. Does WDNR have too much baggage to lead such efforts? WDNR is burdened with past management failures, a whole host of other tasks, and are (sic) rarely given the respect they (sic) are due. The optimal situation may be full-time leadership by a more local organization assisted by technical WDNR assistance.

4.9 Miscellaneous barriers

The last barriers to implementation result from decisions of upper management or legislators.

The main criticism of the draft plan voiced by committee members is that it is too general. One member stated: "It is like motherhood and apple pie. Who doesn't want less erosion and higher water quality?" There is little direction in the draft plan. There is no stated time frame or defined stretches of water on which managers should concentrate. Prescribed tactics are lacking.

Staff admits the plan is general, but states the plan was formulated in this manner on purpose. Being too specific could alienate the watershed actors and spell failure for USRWI. For example, Dane County's Land Use and Transportation Plan is only advisory and is currently being considered for adoption by Dane County governments. Several towns voted against adoption because they feel it would usurp their power. The optimal plan must provide strategies, but not alienate governments.

Formulating such a plan is difficult because of the lack of steady funding and because of the short timeframe of the grant. To prescribe long-term tactics requires base information. Obtaining quality erosion, hydrologic, socioeconomic, and other data requires at least two years. Staff were forced to begin the planning process without sufficient data.

A summary of implementation barriers is presented in Table 3 and Figure 2.

Table 3. Implementation Barriers

I. Institutional and Organizational Barriers

- Lack of stakeholder participation
- Uninteresting meetings
- Lack of communication back to constituents
- Community unwillingness to spend own money
- Watershed management is not a high priority
- Parochialism/lack of intergovernmental cooperation
- Non-uniformity

II. Lack of Local Citizen Participation as a Barrier

- Lack of action
- Too much time devoted to planning relative to action
- Funding appropriation

III. Administrative Barriers

- Training/expertise of staff
- LTE as I and E coordinator
- Full-time job, only part-time help
- WDNR as leader or just technical assistance provider?

IV. Miscellaneous Barriers

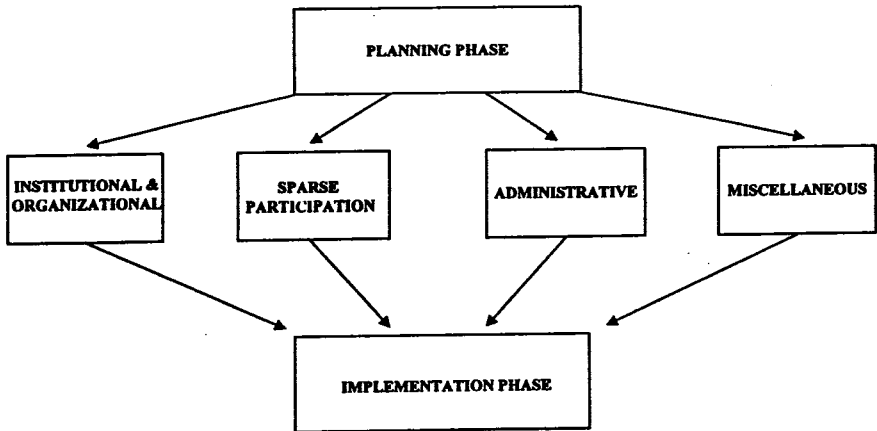
- Plan is too general
 - Lack of steady funding
 - Short time frame
-

5. Recommendations

There are two general categories of recommendations outlined: (1) recommendations to increase prospects for success of USRWI, and (2) recommendations for future IEM efforts. Although separated here, recommendations in these categories are not entirely distinct from each other. Some advice specific to USRWI may also apply to IEM generally as well.

5.1 Recommendations specific to USRWI

Institutional and organizational barriers often are significant obstacles to IEM efforts. USRWI is no exception. USRWI has no enforcement or funding authority and, therefore, must rely on voluntary compliance. There is a lack of intergovernmental cooperation and a high level of non-uniform management. The watershed is plagued with a what's-in-it-for-me attitude. These problems stem, in part, from the fact that watershed management is not a high priority for local governments and citizens.

Figure 2. Implementation barriers

Watershed management must be elevated to higher priority status in order to break down many of these institutional and organizational barriers. Several strategies can be utilized. More governments must be part of the coordinating committee. If the governments currently involved, less than half in the watershed, fully implemented the plan, lack of holistic implementation would inhibit optimal outcome achievement. Broader representation will help make USRWI a higher priority across the entire watershed. Additionally, these same governments must appoint higher level representatives to the committee. Appointment of underlings, who have little influence, may not allow for a meaningful discussion of USRWI.

Coordinating committee members must be good communicators. Current members do not adequately relay information to their governments or constituencies. There is a general lack of awareness of USRWI. Better communication is required to increase the likelihood that governments and individual citizens will support USRWI.

Governments must be given an incentive to be involved. Relying on the "land ethic" that Leopold proposed in 1949 is unrealistic. One solution is to provide cost-sharing funds to foster involvement in watershed management.

If cost sharing can be characterized as the carrot, then threatening the political survival of elected officials can be considered a stick. Every politician

interviewed admitted public outcry would significantly increase government support. However, citizens are unaware of USRWI and the degradation of the river system. There is no citizen pressure about USRWI. Thomas Jefferson once stated:

I know of no safer depository of the ultimate powers of society than the people themselves, and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion.

Jefferson refers to I and E campaigns. The planning process must inform and educate the citizenry. Increased publicity and more interesting meetings, addressing both short- and long-term goals, could enhance meeting attendance. Newsletters that explain the watershed, the role USRWI is playing, and accomplishments to date are recommended. Biennial picnics could create a sense of ownership and camaraderie. Finally, reinstating the Upper Sugar River Watershed Association would provide a forum for I and E and create a cadre of volunteers for on-the-ground projects.

Committee members have recommended that staff periodically present USRWI information to each government in the watershed individually. Several members also believe USRWI and local governments should sign agreements about the plan and initiative's advisory role. This step is recommended; however, more formal boundary agreements are difficult to facilitate and may not be worth the effort to establish. Energy may be better spent elsewhere.

A second strategy to increase local citizen participation is to be more action oriented. The two general goals of the coordinating committee are: (1) increase local citizen participation, and (2) develop an action plan. To date, USRWI has focused on the latter. Hands-on strategies that are small and relatively inexpensive projects should be undertaken soon. Small projects may not be the most efficient use of funding in the short-term, but forming a citizen coalition and partnerships will be beneficial in the long run.

Another potential impediment to hands-on projects is the lack of strategic focus in the draft plan. The planning process should have focused on general long-range goals that require governmental action, while identifying strategies to complete short-term projects. Although already two years into USRWI, the final draft of the plan should outline short-term strategies that build on small successes.

A third strategy to increase public participation may be to create a crisis mentality. DCLCD recently completed preliminary studies of sediment loading in the Upper Sugar River. These findings reveal that sediment loading is similar in magnitude to that of Lake Mendota. Most local people identify Lake Mendota as a highly eutrophic lake in a degraded system. If final findings are similar to preliminary statistics, it could be possible to paint this as a crisis situation.

The final recommendation is that a charismatic leader must be found. No local champion has materialized. This lack could be due to inaction, lack of publicity, etc. Staff must recruit a leader. This may entail funding a part-time executive officer to head the watershed association. This funding approach is similar to many volunteer fire department arrangements in which two volunteers are hired as chief and assistant chief with small monetary compensation. Someone interested in the watershed as an occasional volunteer might be persuaded to become a leader if compensation were given.

5.2 Recommendations for future IEM efforts

These recommendations concern barriers that can be avoided by future IEM efforts, but are beyond being addressed by USRWI and, therefore, will not be examined in detail. Because these recommendations are based on only one case study and because each management situation is unique, the current conclusions may not be universal.

The first recommendation is that IEM should be the responsibility of an environmental planner or similar professional who has a social science, planning, and/or group dynamics background.

The second recommendation is that watershed management should be accomplished on a full-time basis. Two part-time staffpersons for USRWI cannot manage as effectively as one full-time employee could.

The third recommendation is that fund allocation be considered more carefully. The amount of money used for staffing relative to hands-on projects was high for USRWI. More money aimed at on-the-ground projects might prove the most effective strategy in the long run.

Finally, if watershed management is to be successful, DNR and EPA personnel must reexamine the short time frame in which success is expected and the brevity of stable funding. IEM is not a quick fix, but a long, arduous task. Possibly fewer dollars should be provided while data are gathered and small projects are implemented. As support builds and data gathering nears completion, increased funding could be applied to planning. An ample amount of money must be allocated for implementation.

Recommendations are presented in Table 4.

6. Conclusion

IEM is a relatively new approach to resource management that is being applied to the Upper Sugar River watershed. Despite its many advantages, IEM is not a widely used approach. Impediments to successful implementation of an IEM approach have been highlighted in the Upper Sugar River watershed initiative case study. The initiative is near completion of the planning phase. An

Table 4. Summary of recommendations

I. Recommendations for USRWI
A. Increase the priority of watershed management

- Broader governmental representation
- Appointment of higher level governmental representatives
- Better communication between committee members and their governments and citizens
- Cost sharing as a carrot
- Citizen outcry as a stick
- Sign agreements with governments recognizing an advisory role

B. Increased citizen participation

- Information and education campaign
- More interesting meetings
- Newsletters
- Picnics
- Upper Sugar River Watershed Association
- Individual government informational meetings
- Build on small successes
- Strategic focus
- Paint a crisis picture

C. Need for leadership

- Part-time executive officer

II. Recommendations for IEM Efforts in General**A. Adequate staff background****B. Full-time watershed manager****C. Careful consideration of fund appropriation****D. Adjusting time frame and funding schedule**

optimal framework for implementation, however, has not been constructed. Four general categories of implementation barriers exist: (1) institutional and organizational barriers, (2) lack of local citizen participation as a barrier, (3) administrative barriers, and (4) miscellaneous barriers. The recommendations of this article may provide useful information to watershed managers in the Upper Sugar River watershed and across the state so that IEM can be more successfully accomplished.

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