STORMWATER MANAGEMENT IN INTEGRATED RESOURCE PLANNING

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INTRODUCTION

Integrated resource planning (IRP) is emerging as a new paradigm for environmental planning, particularly in the field of water resources management. While some observers believe that new approaches are in large part only new rhetoric and actually can be subsumed under the old, established paradigm of rational, comprehensive planning (Bauer, 1995), others see the emphasis on IRP as fundamentally new or at least an innovative extension of older approaches.

Complicating factors in interpreting approaches to planning that have been grouped or categorized as IRP are the problems of definition and scale. MacKenzie (1996), for example, uses the terms *Integrated Resource Planning and Management* to refer to implementation of an *ecosystem approach* within the Great Lakes Basin, a huge region totaling more than 95,000 square miles. Buckley (1995) uses the term *integrated* in the context of watershed management and focuses on synthesis of objectives in federal water statutes and how these objectives have been addressed in regional and local watershed management programs. Beecher (1995), in contrast, uses IRP in a narrower context, referring primarily to developments in the water utility industry and the role of planning in water supply and management, including its roles in systems development and in shaping regulation of water utilities. Regardless of the context of a particular discussion or application, however, the idea of IRP consistently brings to mind several images, both process-oriented and substantive.

IRP refers to a planning approach that is more flexible, participatory, and inclusive than traditional approaches. The approach involves planning for multiple objectives, use of a wide array of policy tools and interventions, more reliance on market mechanisms than traditional command and control processes, and iterative consideration of goals and objectives. In water resources applications, it involves simultaneous consideration of all hydrologic and engineering processes that affect the resource, including

water supply, wastewater treatment, stormwater management, and other processes or uses such as cooling, navigation, low flow augmentation, recreation, flood control, and environmental management. MacKenzie (1996: 6-7) distinguishes the integrated approach by its focus on ecological integrity, the perception of an ecosystem as self-sustaining, the use of natural ecological boundaries, and a holistic orientation toward resource management.

Beecher (1995) is more specific, describing the basic elements of an IRP, steps for establishing an IRP process, and tools used commonly in IRP. Within the context of water supply (and, to a lesser degree, wastewater management), she systematically compares traditional planning and IRP processes, noting differences in planning orientation, planning process, and planning issues. Her analysis is particularly useful because of this comparison. Beecher does, however, limit her analysis to consideration of water and wastewater issues. She does not explicitly address issues such as stormwater management and nonpoint source pollution that are integral to analyses by MacKenzie (1996) and Buckley (1995).

The purpose of this paper is to extend Beecher's analysis and to examine how stormwater management fits in an IRP framework. Beecher's framework is adapted and used to demonstrate how trends in stormwater management are both consistent with those in water supply and wastewater and representative of IRP. The paper begins with a brief comparison of traditional planning and IRP that focuses on criteria or considerations that can be used to distinguish the two. These criteria then are used to compare traditional and newer approaches to managing stormwater and nonpoint source pollution. To better illustrate how trends in stormwater management mirror those in IRP, special emphasis is placed on the role of alternative approaches to financing, particularly recent trends involving the development of stormwater utilities. The paper concludes with some observations about ways

in which trends in stormwater management both mirror and can be incorporated within IRP.

TRADITIONAL AND INTEGRATED RESOURCE PLANNING

The structure of the IRP process, at least as outlined by Beecher (1996: 44) differs little from the structure of the rational planning process outlined in the planning literature for decades (see, for example, Chapin and Kaiser, 1985 or So, 1986). Planners identify needs, develop feasible alternatives, generate scenarios and evaluate impacts, select alternatives, implement them, monitor outcomes, and complete the process iteratively. What differentiates IRP from traditional planning processes is the perspective that planners bring to the process and the manner in which each step of the process is conducted. The planning *orientation* is broader and informed by a wider range of considerations, the planning *process* is more open, and a wider array of *issues* are addressed (Table 1).

Compared with traditional planning, the orientation in IRP involves a wider number resource options, greater diversity in ownership and control of elements of the resource, broader geographical and institutional scopes for planning, explicit use of more criteria for evaluation of alternatives, and greater participation in selection of resources and alternatives (Table 1). The process of IRP is more flexible, emphasizes inclusiveness and participation (sometimes with a sacrifice of efficiency), involves explicit consideration of preferences of stakeholders, and uses more and newer tools for conflict management. Finally, a more diverse, complex set of issues is routinely addressed. These issues include both substantive issues that have to do with the nature of the resource and managerial and administrative issues such as cost, financing, efficiency, and tradeoffs in balancing competing objectives and in managing uncertainty and risk. The differences between traditional planning and IRP in orientation and process and the way in which these differences manifest themselves in consideration of a broader array of issues can be seen clearly in trends in stormwater management and nonpoint source pollution control.

STORMWATER MANAGEMENT IN INTEGRATED RESOURCE PLANNING

Decision makers have rarely accorded stormwater management, the third dimension of local water resources management, the same priority as water supply and wastewater treatment. More than thirty years ago, for example, in an article that presaged the integrated, ecosystem approach, Wolman (1965) chronicled the development of modern water supply and wastewater treatment systems in the nation's cities. He did not, however, explicitly address the problem of stormwater management. In the period since, the nation has developed far-reaching federal and state regulatory programs to guarantee both safe drinking water and acceptable levels of ambient surface water quality.

These programs have established standards for drinking water (the maximum contaminant levels for public water supply systems) and effluent limitations on point source discharges from both private industry and publicly owned wastewater treatment plants. With the exception of the relatively unsuccessful Section 208 planning process in the 1972 Clean Water Act, these programs have not emphasized protection of groundwater resources or control of pollutants in agricultural or urban runoff. Kundell (1995) notes that federal statutes did not focus on stormwater management and management of nonpoint sources of pollution until passage of the 1987 amendments to the Clean Water Act (in Sections 402(p) and 319, respectively), and that these problems only are beginning to be addressed. At the local level, stormwater management has usually been given low priority, primarily addressed as an afterthought from the perspective of drainage in development proposals, and rarely from the perspective of water quality. Now, however, stimulated in part by the recent federal initiatives, new approaches to stormwater management are emerging (Table 1).

The newer approaches to stormwater management mirror trends characteristic of IRP. The orientation is broader: instead of focusing on drainage and conveyance and sometimes on flood control, new options range from better site design to minimize runoff to implementation of best management practices (BMPs) such as artificial wetlands to control pollutants in runoff (Table 1). In the traditional approach, developers have been responsible for on-site drainage and municipalities have been responsible for conveyance off-site. In newer approaches, roles of developers, individuals, homeowners associations, and local and regional governments are evolving, and options like regionalization, trading of credits for on-site control, and privatization of maintenance of BMPs are being explored. The geographic scope of planning has expanded from site planning only to explicit consideration of downstream effects in the context of watershed analyses. While the cost of infrastructure historically has been the principal criterion for evaluation of alternatives, new approaches treat cost as one of several criteria, including factors such as water quality impacts, habitat considerations, and visual amenities. Instead of relying solely on engineering standards and specifications for review of the adequacy of conveyance facilities and stormwater structures, procedures now require consideration of other factors, including ecological effects.

The new approaches to stormwater management are more dynamic and flexible (Table 1). The use of checklists and other simplistic review procedures is declining and being replaced with processes that involve use of performance standards. These processes provide developers more flexibility in meeting management objectives but require that staff responsible for review have more experience and expertise. Design and approval processes, once largely closed to participation, are opening up, and preferences of stakeholders are being considered explicitly. Significant effort is being made to move beyond adversarial approaches to project review. New participatory approaches to site planning and design are being pursued, and new tools such as dispute resolution are being used to manage conflict.

The consideration of a wider variety of options within newer, more flexible processes is resulting in explicit evaluation of a wider, more complex set of issues (Table 1). While efficiency of drainage used to be the main consideration in project evaluation, it is now just one of a number of decision variables. As Beecher (1995) points out, environmental quality now is an objective, not a constraint, and benefit-cost calculations are not limited to consideration of only costs of construction. Social costs and benefits -- the value of both negative and positive externalities -- now are being weighed explicitly, as are tradeoffs in projected outcomes of decision variables. Much of the analysis of trade-offs has to do with management of levels of risk and uncertainty, which historically has been assumed away. Consistent with these trends, innovative approaches to pricing and financing stormwater services are being developed. These new approaches range from impact fees to charges for impervious area to creation of mitigation banks for control of pollution in stormwater. These newer approaches to financing stormwater services illustrate particularly well how trends in stormwater management fit within an IRP framework.

Following innovations in the mid-1970s in Bellevue, Washington and in Boulder and Fort Collins, Colorado, increasing numbers of municipalities and other local governments have begun to finance stormwater management services with revenues from stormwater user charges imposed through an approach generally called the stormwater utility approach. Several hundred stormwater utilities now exist, and more are in the planning stages. The utility approach involves paying for basic stormwater services with charges based on the amount or percentage of impervious area on a parcel rather than with general revenues from property or other taxes not related directly to the use of stormwater infrastructure or to the benefits received from stormwater services. Charges for single family residential homes, which range from $15 to nearly $100 per year (Water Environment Federation, 1994), are being used to finance traditional operations and maintenance as well as new programs to control pollutants in urban runoff.

Numerous professional organizations and experts have argued that the utility approach has many advantages. From the perspective of revenue generation, charge systems are more stable, and charges may be more desirable than traditional measures from both efficiency and equity perspectives (Lindsey, 1990). In some situations, for example, charges appear to be used as demand-management measures: developers can obtain reductions in charges for on-site controls and other BMPs. The theory behind development of charge systems thus resembles the theory behind new approaches to financing water utilities described by Beecher in her analysis of IRP. Moreover, delivery of stormwater services is being integrated with management of water and wastewater systems. A recent survey of 139 water and wastewater utilities found that 27 percent also were providing stormwater management services (Raftelis, 1996).

SOME CONCLUDING OBSERVATIONS

The development of IRP reflects the both better understanding of the nature of successful planning and the maturation of our efforts to manage water resources. Planners and others involved in the policy sciences have learned that open, flexible, participatory processes lead to identification and selection of alternatives that have higher probabilities of being implemented and achieving stated objectives. Scientists, engineers, and others involved in the design of programs to provide safe drinking water, improve ambient water quality, and protect groundwater resources have learned that the water resource must be managed as a system, accounting for natural and social linkages in function and use.

Past efforts in water resources management have focused on delivery of clean, safe drinking water and control of point sources of pollution. As the more obvious problems have been solved and science has improved, we have gained better understanding of the significance of the problems caused by pollution in stormwater runoff and other types of nonpoint source pollution. Continued progress in managing the water resource depends on integration of stormwater programs into existing programs for water supply and wastewater management. IRP holds promise as the best approach to achieving this goal.

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TABLE 1
TRADITIONAL AND INTEGRATED RESOURCE PLANNING: IMPLICATIONS FOR STORMWATER MANAGEMENT

Criteria	**Traditional Planning for Stormwater Management**	**Approach in Integrated Resource Planning**
Planning orientation		
Resource options	drainage and conveyance some quantity management, mainly for flood control	site design to minimize runoff drainage and conveyance water quantity management (detention, retention) water quality management (infiltration, artificial wetlands)
Resource ownership and control	homeowner responsible for drainage local government responsible for conveyance downstream owners responsible for coping homeowner's association responsible for stormwater management structures	homeowner responsible for drainage local government responsible for conveyance privatized maintenance of conveyance system homeowner's associations and municipalities share responsibility for stormwater management structures intergovernmental cooperation in setting management goals and responsibilities
Scope of planning	site planning only single objective, usually to drain water as quickly as possible	site planning in watershed context; off-site effects considered multiple objective, to balance development, drainage, management, and environmental objectives
Evaluation criteria	cost to development	cost to development adequate drainage control of nuisance and severe flooding water quality impacts habitat considerations maintenance of base flow amenities
Resource selection	developer administrative review by local authorities	developer administrative review by local government consistency with multiple criteria and watershed objectives

Table 1 (continued)		
Criteria	**Traditional Planning for Stormwater Management**	**Approach in Integrated Resource Planning**
Planning process		
Nature of the process	closed, inflexible, based on design standards	open, flexible, based on performance standards
Judgment and preferences	choices made by developer's engineer; values implicit in selection of alternative	choices made by developer's engineer in consultation with planning officials; explicit consideration of different values
Conflict management	administrative review and formal procedures for appeal and litigation	negotiation, dispute resolution, and consensus-building
Stakeholder's identity	developer and local government officials	developer and local government officials state and federal regulators homeowner and environmental interests
Stakeholder's role	adversarial	participatory
Planning issues		
Drainage and conveyance	only or highest priority	one of several decision variables
Environmental quality	planning constraint	planning objective
Cost considerations	costs to developer	costs to developer social costs (costs of externalities)
Financing, pricing, efficiency	developer homeowner's associations general funds (property taxes)	developer or developer exactions impact fees homeowner's associations general funds (property taxes) stormwater utilities financial incentives for on-site controls
Trade-offs	addressed implicitly or ignored	addressed explicitly
Risk and uncertainty	to be reduced or avoided	to be analyzed and managed

Note: Criteria adapted from Beecher (1995).