Integrated Watershed Management: Past, Present, and Future

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INTRODUCTION

On September 26, 1968, the National Water Commission (NWC) was established in the United States as a consequence of an Act of Congress approved by the President. The activities leading to the establishment of the U.S. National Water Commission originated in conflicts over the proposals to build new dams on the Colorado River in the Grand Canyon, to implement the Central Arizona Project to divert water from the Colorado River to the states of Arizona and New Mexico, and to study the importation of water into the Lower Colorado from adjoining states. The issues associated with these proposals prompted the Congress and the President to create the National Water Commission and give it broad authority to examine present and anticipated national water resource problems and give emphasis to alternative ways to meet future needs.

The NWC was directed to consider economic and social consequences of water development. This effort differed from past federal water policy initiatives in that the NWC was charged with "studying all water problems, programs, and policies in the context of their relationship to the total environment..." (NWC, 1973) Institutional arrangements were considered by the NWC as well.

In England in September 1969, an initiative by the Central Government began which ultimately resulted in the creation of ten (10) regional water authorities to provide for comprehensive water services in all of England and Wales. The factors which prompted the Central Water Committee being directed in 1969 to consider the best organizational arrangements for carrying out comprehensive water services included the following (Bulkley, et. al., 1975):

1. The projected increase in demand for water by the year 2000 would pose severe difficulties under existing organizational arrangements.

2. It is anticipated that water re-use will increase and therefore a much greater concern will be required for treatment provided water after use.

3. There should be a sweeping reduction in the number of separate operating units providing sewage disposal and a further reduction in the number of separate operating units providing water supply.

4. There were increasing conflicts of interest between the various authorities (local units of government, water supply groups, etc.) and inadequate mechanisms for resolving these conflicts apart from intervention by Central Government. The most important areas of conflict included the following:

   a. Inflexibility in the use of existing water resources.
   b. Divided responsibility for new sources of water.
   c. Difficulty in the promotion of joint or national schemes.
   d. Conflicts of interest with regard to water reclamation and water reuse.

5. A need existed to be able to implement plans once agreed upon. Previous management and financial arrangements made implementation most difficult.

6. A need existed to improve planning and coordination.

7. It was determined to have both a five year capital works plan for each area as well as a long-term (20 year) capital water plan for each area or region.

These issues identified in England and Wales twenty-six years ago resonate with issues observed in this country today. The balance of this paper will consider the outcomes of the two national efforts - one in the U.S. and one the U.K., plus it will focus upon present and future watershed activities. Specific examples will be cited for two watersheds in the state of Michigan.

THE REGIONAL WATER AUTHORITIES: ENGLAND AND WALES

A detailed account of the factors leading to the comprehensive institutional reorganization for the provision of water services in England and Wales in available (Okun, 1977). For the purposes of this paper it should be noted that the central government concurred with the recommendations of the Central Advisory Water Committee—namely the establishment of strong regional bodies based upon watersheds was absolutely necessary in order to effectively solve the current and future water

issues of England and Wales. In January 1973, The Water Act of 1973 to reorganize the water industry was introduced in Parliament. This Bill passed Parliament in July 1973 and R-Day (Reorganization Day) took place on 1 April 1974. This reorganization for all of England and Wales replaced more than 1600 separate water service entities with ten (10) Regional Water Authorities whose boundaries were defined by the watersheds of the country. As public bodies, the Regional Water Authorities in England and Wales existed from 1 April 1974 to late 1989. In July 1989, Parliament passed a new water bill which resulted in the privatization of the ten regional water authorities by the end of 1989.

The privatization under the conservative government reflected the belief that the financial needs of the regional water authorities for major investment to repair replaced capital works would be best met through the private sector. The commitment to the watershed focus was reaffirmed and not altered. New legislation was passed in 1995 which further affirms this commitment to water management on a watershed basis. This new legislation replaces the National River Authority which was created by the privatization Bill in 1989 with a new governmental organization to integrate and combine air/land/water protection within a single unit. The result of this most recent legislation will be to strengthen comprehensive water management at the watershed basis as established in 1974. Accordingly, the watershed focus for comprehensive water planning and management has been well established for more than twenty years and is being maintained into the future.

THE NATIONAL WATER COMMISSION: U.S. (1968-1973)

This major policy study in the United States examined the full range of water issues from forecasting future demands for water (Chapter 1) through Basic Data and Research for Future Progress (Chapter 17). Two chapters, Improving Organizational Arrangements (Chapter 11) and Water Problems of Metropolitan Areas (Chapter 12), specifically addressed organizational and institutional changes needed to enhance the capacity of the country to handle water problems both now and in the future. Sections D and E of Chapter 11 addressed the organizational needs for water planning and management in river basins and the Great Lakes. The focus on river basins and the Great Lakes provided a watershed emphasis in the commissions recommendations.

The Water Problems of Metropolitan Areas clearly identified a set of problem topics that are remarkably similar to those identified in England and Wales. Consider the following (NWC, 1973):

1. Inadequate or unnecessarily costly service because too many different water agencies are operating within the same metropolitan area.

2. Poor integration of water supply, wastewater treatment and drainage services with each other and with planning for the use and occupancy of land.

3. Insufficient attention to the non-utility aspects of providing metropolitan water services—including neglect of recreational, esthetic, and environmental values.

4. Inadequate data, particularly on current water management practices in metropolitan areas.

5. Inability to finance future water needs of metropolitan areas.

6. Inadequate institutions for managing metropolitan water services and for determining and representing metropolitan viewpoints in federal, state, regional, and multistate water management.

7. Water pollution, a substantial portion of which comes from non-point sources outside current pollution control programs, particularly in growing communities.

8. The encroachment of urbanization upon watersheds and the resulting deterioration of the quality of water supplies.

The NWC developed thirty-six specific recommendations for action as a consequence of the issues and problems documented in Chapters 11 and 12. One of the basic recommendations stated the need to continue to explore ways to consolidate the tasks in providing for water services in order to achieve efficiency and economics of scale wherever possible. An overall theme which emerges from this large set of organizational and institutional recommendations is the Commission's strong belief that development, management, and protection of water resources should be controlled by that level of government nearest the problems and most capable of effectively representing the vital interests involved. (NWC (summary), 1973) Over time, the NWC called for a greater role for state agencies, regional entities, and local units would assume greater roles in the control of water resource use and preservation. (NWC (summary), 1977).

PUBLIC LAW 92-500: 1972 AMENDMENT TO FEDERAL WATER POLLUTION CONTROL ACT

Public Law 92-500 established Section 208, Area-Wide Water Quality Planning and Management. In fact, these

1972 Amendments presented a planning and management sequence which required river basin plans (Section 303) to be followed by area-wide water quality planning (Section 208) to be followed by facility construction (Section 201). In actual fact, the U.S. EPA preceded directly with the implementation of Section 201 - facility construction without following the prescribed planning sequence of Section 303 followed by Section 208 prior to facility construction (Metzger et al, 1978). Accordingly, the opportunity for a sequential planning process for water quality control under the provision of the 1972 Amendments was lost. One factor which contributed to this decision to proceed to construction was the perceived need of the urgency of the existing surface water quality pollution problem and the pressure from communities to build needed facilities. It should be noted that the legislative history of the Water Pollution Control Act Amendment of 1972 does not demonstrate significant Congressional debate on Section 208, although Senator Muskie (Maine), a principal author of the Act, endorsed the river basin (Watershed) concept as one possible alternative for Section 208 (Metzger et al, 1978). Institutional conflicts combined with the decision to proceed with facility construction ahead of the legislatively mandated planning process proved to be fatal to the effectiveness of Section 208 with regard to water quality planning.

CURRENT SITUATION

Clean Water Act Amendment of 1987

The Clean Water Act Amendments of 1987 brought a number of major changes including a new initiative on non-point source pollution. In addition, the construction grants program was phased out and the state-revolving fund (SRF) program for loans to public entities for water pollution control implemented. The Clean Water Act would again be considered for reauthorization in 1992. In 1989, a specific national activity took place which was designed to prepare an overall water agenda for the 21st century and help focus upon new water quality directions for the reauthorization of the Clean Water Act in 1992.

Water Quality 2000

In May 1989, a small group of water professional met at the Wingspread Conference Center in Racine, Wisconsin to consider how to proceed with such a Water Agenda for the 21st Century. This conference was actually the second on this subject at Wingspread; the initial conceptual meeting took place in 1988. The participants at the 1989 meeting focused upon the development and approval of a Vision Statement and a Goal for the Water Quality 2000. The Vision Statement and Goal were adopted on May 19, 1989 and are as follows:

Vision Statement: Society living in harmony with healthy natural systems

Goal: To develop and implement an integrative policy for the nation to protect and enhance water quality that supports society living in harmony with healthy natural systems.

The Water Quality 2000 effort had four phases. Phase 1 was completed in May 1989 with the adoption of the Vision Statement and the Goal Statement and the development of the work plan for Phase II, III, and IV. In June 1991, Phase II, Problem Identification, was completed with the publication of an interim report Challenge for the Future. This interim report provided a comprehensive review of current water quality problems, their cases, and identified impediments to solutions. Phase III involved the work of a multi-disciplinary working group of over 100 volunteer experts. The culmination of this 18 month effort from June 1991 to November 1992 is the Phase III Report - A National Water Quality Agenda for the 21st Century. For the purposes of this paper, it is important to note that the Phase III Report from Water Quality 2000 concludes that a new national water policy is needed to integrate planning and management to protect surface and ground water resources with related societal activities under a watershed framework (emphasis added) (Water Quality 2000, 1992). The three basic strategies which were identified by Water Quality 2000 to comprise the new policy framework are as follows:

A. Protecting water resources by preventing pollution,

B. Empowering all segments of society to contribute to water resource improvements through increased individual and collective responsibility, and

C. Planning and managing water quality and on a watershed basis.

Phase IV of the WQ 2000 is the implementation of the National Water Agenda for the 21st Century and after Phase III concluded in November 1992 and Phase IV is continuing.

U.S. EPA: OWOW

In April 1991, U.S. EPA's Office of Wetlands, Oceans, and Watersheds (OWOW) was created to integrate the protection and management of the Nation's watersheds, coastal and marine waters, and wetlands.

The Administration's February 1994 Clean Water Initiative

The Clean Water Initiative submitted by the Administration to Congress in February 1994 (U.S. EPA, 1994) reflected a host of concepts and ideas. Among the key elements contained within the Clean Water Initiative would be the following:

- Expanding from point source pollution control to non-point source pollution control (watershed).
- Changing the institutional structure from federal command/control to state initiative (leadership).
- Since 1972 the population of the country has increased by 25% and the economy has increased by 50% and surface water quality has improved.
- Non-point source pollution in now the greatest single source of water quality impairment.
- Need flexibility to tailor the solutions to fit the problems.
- Need to assume that funding allocated to address water quality problems is used most effectively and efficiently.

The Administration's Clean Water initiative included specific watershed activities at the state level.

- Consider the following:
- Identification of the responsible state agency.
- Determination of watershed boundaries throughout the state.
- Selection of prioritized watershed.
- Schedule of achieving environmental objectives by watersheds.
- Designation of Watershed Management initiatives
- Identification of state environmental objectives.
- Identification of necessary elements of watershed planning, management, implementation, monitoring and reporting requirements.

The failure of the Congress to reauthorize the Clean Water Act in 1994, and the subsequent national elections and new Congressional leadership has resulted in uncertainty as to whether or not those types of watershed provisions will emerge in the new reauthorization of the Clean Water Act.

The Administration is proceeding to implement the watershed approach even though the Congress has not re-authorized the Clean Water Act (Perciasepe, October 1994). The U.S. EPA created a Watershed Policy Committee and this group will oversee the development of an action plan to include the following elements:

- Enhance interagency coordination: federal interagency - federal-state
- Build state watershed programs
- Expand the toolbox—develop tools
- Improve Intra EPA Coordination
- Reach out to watershed stakeholders

The vision for EPA's Watershed Approach has certain similarities to Water Quality 2000's Vision statement:

> "Clean Water and healthy, sustainable ecosystems as a result of comprehensive yet tailored water resource management everywhere."

In a subsequent document, Robert Perciasepe laid out the National Water Program Agenda for the future (Perciasepe, December 30, 1994). The overall concepts which are embodied in the National Water Program Agenda are the following:

- Apply Common Sense in all we do
- Organize, Work, and Communicate to Protect Places.

Both of these concepts call for the watershed approach in the management and protection of water quality and water quantity. In addition to these two overall concepts, the agenda calls for purposeful action to protect the environment by improving wet weather flow controls. One of the specific actions included here is to encourage state and local partners to target wet weather programs to protect surface and groundwater on a watershed basis.

It is very clear that U.S. EPA is vigorously seeking to implement watershed-based planning and management to enhance the quality of both surface and goundwater.

The National Forum on Nonpoint Source Pollution

In January 1994, the Conservation Fund and the National Geographic Society convened the National Forum, Co-Chaired by Governor John Engler of Michigan and Governor Howard Dean of Vermont. The Forum, was challenged to identify and demonstrate innovative, non-regulatory solutions for non-point source pollution based on education, voluntary initiatives, and economic incentives. The Executive Summary of the National Forum was completed in May 1995. The Fall Report is scheduled for completion by August 1995. Consider the following points from the Executive Summary:

A. The framework for our actions needs to be watersheds rather than political jurisdiction. (Governor Engler/Governor Dean)

B. Watershed, rather than political boundaries, are the models provided by nature. They should be used as framework for action.

C. Each of us - children, homeowners, farmers, small business owners, local government officials - should become aware of the watershed where we live.

D. We should organize water management along watershed boundaries. The water flowing in a stream does not stop at the border of a state or nation, and neither does nonpoint pollution. And yet we continue to manage our nation's water resources along these artificial political boundaries. Watershed management will allow us to deal with nonpoint pollution in a comprehensive, integrated manner. Leadership at the federal and state levels is needed to make this happen.

Clearly, there is recognition in the Forum of the critical need for the watershed approach.

U.S. Army: Corps of Engineers

At the 53rd meeting of the Chief of Engineers Environmental Advisory Board (EAB) - Washington, D.C. in April of this year, the Chief of Engineers charged the EAB to begin to formulate principles for environmental partnering between the environmental community and the Corps of Engineers. One of the recommendations developed by the EAB and submitted to the Chief of Engineers calls for the Corps to use the watershed/ecosystem approach as the holistic, integrated concept on which to base (water resources) planning.

WATERSHEDS: TWO EXAMPLES

The Raisin River Watershed Surface Water Quality Management: The Policy Map

A special interdisciplinary research effort at the University of Michigan focused upon the Raisin River Watershed by combining land use planning, biological and hydrological studies, computer modeling, and historical and political analyses. The objective has been to consider all aspects of the relationship between land use and surface water quality. The River Raisin is located in the southeast corner of lower Michigan, and flows into the western basin of Lake Erie. The drainage basin for the 135 mile long river covers 1072 square miles (2776 km^2). Rumored to be "the most crooked river in the world," the Raisin rises in the western end of the basin 1200 feet above sea level on the steeper, forested slopes of the Irish Hills and winds southeast through glacial moraine topography to a lake plain dominated largely by corn and soybean agriculture. Finally the river passes through industrial Monroe and drains into Lake Erie. At least 50 dams and impoundments, and several major tributaries, mark the river at various points along its course.

The watershed is dominated by agriculture, with 80% zoned for farmland. Its original topography has been significantly altered by clearing forests, and draining and filling wetlands for farms and residences. Residential development is presently concentrated along the river and its tributaries, but development pressure from Detroit, Ann Arbor, and Monroe is expected to increase throughout the watershed over the next 15 years. Presently, non-point source pollution from agriculture is identified as the single most significant water quality problem in the basin. In the past, the area has had problems with point source discharges, and presently has 47 sites with National pollution Discharge Elimination System (NPDES) permits. In addition, the last 2.6 miles of the river, as it flows through Monroe, have been designated a Great Lakes Area of Concern (AOC) for contaminated sediments and poor water quality, notably PCB contamination. Attempts are being made to address the basin-wide causes of pollution. In the last five years, MDNR Fisheries Division personnel have completed a draft study of the health and extent of fish populations and habitat throughout the watershed. Currently the River Raisin Remedial Action Plan (RAP) is also being developed with a focus that will address upstream as well as AOC sources of contamination and degraded habitat.

The total population of the watershed is about 80,000. The watershed is located within five counties, has six cities, ten villages, and forty-one townships. Five federal agencies are directly involved in water related activities in the River Raisin Watershed; at the state level the Michigan Department of Agriculture and the Michigan Department of Natural Resources have major responsibilities impacting on surface water quality. In addition, two planning regions established by the state of Michigan cover separate portions of the watershed. The institutional interactions are complicated by all of the specific governmental offices acting at the county, municipal, village, and township level. The Policy Map is one approach to consider the relationship between human institutions and institutional activities, land use, and related surface water quality issues. The focus of the Policy Map has been to examine the possibilities for comprehensive watershed planning and management in which policies and institutions protect and manage water resources within the context of a basic hydrologic landscape unit-namely the watershed. (Manson et al., 1994)

To assess the possibilities for comprehensive watershed planning and management within the context of the River Raisin Watershed, the research effort utilized a framework of issues/topics derived from three(3) separate sources, (1) Water Quality 2000's document, A National Water Agenda for the 21st Century; (2) Entering the Watershed, a 1993 Report to Congress by the Pacific Rivers Council; and (3) Michigan's Environmental and Relative Risk Project Report. These three documents presented issues viewed from the national, regional, and state level against which issues identified in the River Raisin Watershed could be compared and assessed.

As a consequence of this analysis eight critical challenges concerning surface water quality management in the River Raisin Watershed have been identified. These critical elements include the following (Manson et al., 1994).

Coordination of institutions and projects on watershed level: requires strengthened role for watershed-level agencies and coordination within/among state and county agencies, including County Drain Commissioners

Ecosystem considerations at all levels of government: requires general attention by all governments to governmental activities which affect ecosystems; specifically coordination, improved environmental monitoring, and establishment of ecosystem criteria

Improved Environmental Education: requires improved coordination, particularly between the watershed council and local school districts, and funding for implementation from school districts and various governmental units

Land use planning for conservation and non-point source prevention: requires attention to zoning and land use restrictions, specifically by local, county, and watershed agencies, and regulation of specific problems by county/state agencies

Non-point source pollution prevention: requires continued and expanded runoff/erosion prevention by soil conservation service and others, comprehensive regulation ofpesticides, and public education programs, possibly coordinated by university or watershed council groups

Point source pollution prevention: requires full cost water and wastewater supply/treatment by local and regional authorities, and state regulation of specific point sources and substances

Riparian and Wetland Restoration and Preservation: requires zoning, implementation on a local/county level, by such groups as Soil Conservation Service, localities, watershed council, and Federal/state attention to wetland regulations, with Drain Commissioner, county, local implementation; also private/public cooperative measures, land trusts

Stabilizing Flow in the River Raisin: requires coordinated drainage regulation on a county or state level, attention at the state/legislative level to the management of dams, lake levels, and withdrawals

The outcome of this Policy Map approach is summarized in two sets of recommendations. These recommendations are designed to assist in the implementation of managing natural resources and surface water quality on the entire watershed of the River Raisin. Before proceeding to these recommendations, it is important to consider a second watershed in Michigan - an urbanized highly polluted watershed.

The Rouge River Watershed: National Wet Weather Demonstration Project

The Rouge River Watershed is also located in Southeast Michigan but it is smaller and much more densely populated than the River Raisin Watershed. The Rouge River

Watershed covers 438 square miles located in portions of three counties, thirteen townships, and thirty-five municipalities. Its resident population is 1.5 million and the river has four main branches with a total length of 127 miles. It is a highly urbanized area with 42% of the area of the City of Detroit contained within the watershed. There is an extensive park system of more than 50 miles along the river providing extensive public access. It is one of the State's most accessible rivers.

There are extensive pollution problems in the Rouge River Watershed. Nearly 30% of the watershed area is served by combined servers. At the present time, CSO's take place from 168 outfall locations in the watershed. Separate storm water runoff from a very large number of storm water discharges is a major pollution source.

The pollution problems in the Rouge River Watershed are derived in large measure from the CSO overflows, the storm water discharges, and the other non-point source pollution reaching the river. The result is that fish consumption advisories are in place, county health departments have prohibited total body contact in the river because of excessive fecal coliforms, major septic tank failures have contributed to this pollution problem. As a consequence, the Rouge River in Southeast Michigan has been designated by the International Joint Commission as

one of the most polluted rivers in the entire Great Lakes Basin, including both the United States and Canada.

The National Net Weather Demonstrative Project provide comprehensive analysis, development and implementation of pollution control methods for the entire Rouge River Watershed, and the pollution source which impact the river quality. The Rouge Project looks beyond political boundaries and is intended to determine a method of selecting the most cost-effective controls for wet weather pollution sources while assuring maximum use of the water resource. There are major technical components included in the Demonstration Project to identify the most cost-effective means to capture and treat CSO. Table 1 shows the nature of these projects and the capital expenditure associated with implementing these technical demonstrative projects.

It is very important to note that a key component of this Rouge Project is the Financial and Institutional Technical Advisory Group. This element is exploring alternative ways to provide the needed services on a watershed basis without being limited by current political boundaries. These financial and institutional issues have been determined to be the most difficult issues facing the Rouge Project. However, the long-term success of the current and future surface water quality in the Rouge River Watershed requires new and innovative means to address these critical financial and institutional issues.

River Raisin Watershed Recommendation

These recommendations as follows (Manson, et al., 1994):

a. Immediate Recommendations:

Local Government Recommendation:

Incorporate Conservation into zoning

(1) Complete master plan and wetlands inventory (Planning Commission).
(2) Develop a stormwater management plan (Planning Commission, County).
(3) Support conservation easements and overlay districts (Planning Commission, Municipal Supervisor).
(4) Identify high priority areas in watershed contributing to surface water quality degradation.

Increase efficiency of water and waste water treatment

(5) Implement enterprise accounting (Public water utilities)

(6) Implement conservation measures at local utilities (Public Water Utilities).

Metering
Leak detection
Non-potable re-use policies
Economic Incentives
Public Education

Implement environmental education programs

(7) Develop and/or adopt an environmental education curriculum for all grades (School District).
(8) Implement public education programs at a local level.

County level Recommendations:

(9) Coordinate and supplement local environmental education efforts (Various Departments).

(10) Coordinate local land use planning efforts, in part by establishing a framework for all master plans and stormwater flow at the local level (Planning Commissions, Drain Commissioners).

(11) Enforce maximum storm flow rates from new development and calculate maximum flow rates for existing drains (Drain Commission).

(12) Establish standards for storm water management applicable to all county departments (Various Departments, County Commissioners).

(13) Establish economic incentives for the installation of conservation measures (County Planning, Drain Commissions, Soil Conservation Service).

(14) Expand efforts of Soil Conservation Service to include all agricultural lands and non-point source issues.

Regional level Recommendations:

(15) Organize, coordinate, and implement basin-wide education efforts (Watershed Council).

(16) Encourage wetland and riparian protection (Watershed, Regional Planning Councils).

(17) Regional planning councils should coordinate with watershed councils in education efforts.

(18) Identify high priority areas throughout the watershed contributing to water quality degradation.

State level Recommendations:

(19) Focus MDNR efforts on a watershed basis, particularly with relation to pesticides and point source effluent permits.

(20) Establish "minimum flow" standard to maintain river health in drought conditions (95% exceedence flow) (MDNR, Watershed Councils).

(21) Facilitate local/regional efforts at planning and watershed-level management (MDNR, Departments of Public Health, Transportation).

(22) Coordinate state departments to fulfill conservation regulations uniformly.

Federal level Recommendations:

(23) Improve funding for Soil Conservation Service Activities, and encourage increased participation of activities (Congress, Department of Agriculture).

(24) Improve riparian protection (Congress, EPA, Department of Agriculture).

(25) Increase and prioritize funding for initiatives that promote a local/regional approach to water quality improvement (Congress, EPA).

Private/Educational Recommendations:

(26) Promote the development of educational materials to be used in the schools to foster an ethic of stewardship, conservation, and careful use of natural resources.

(27) Provide training and educational opportunities (Colleges, Universities, Professional Societies).

(28) Promote economically reliable source reduction and technology (Industry).

Federal Recommendations in A National Water Agenda:

Create a National Water Efficiency Policy
Improve energy efficiency policies
Broaden Protection of Wetlands
Increase R&D for Restoration of Degraded or Converted Aquatic Habitat and Groundwater
Initiate Detailed, Long-term Water Quality Monitoring Programs in Representative Watersheds to Advance the Science of Watershed Planning and Management

b. Long-Term Recommendations:

Establish a watershed-based institution with statutory authority to regulate flow in each watershed.

To avoid the creation of an ineffective bureaucratic entity, enabling legislation for a strengthened watershed level institution should include methods for raising revenue and a specific minimum level of authority. Such authority could take many forms, such as review and permit authority for development sites within a certain distance of the river, and revenue-generating power could be a simple flat fee. Basin residents can decide by vote what authority the institution should have beyond the set minimum. As in the current draft legislation, increasing the authority of the watershed council by popular vote allows voters to choose their own type of government, without reducing the basic powers guaranteed by the enabling legislation.

The regulatory and revenue-generating authority recommended as a basic mission is:

The new watershed institution should establish a viable minimum flow rate for the rivers and tributaries in the basin. This should be completed within a set time of the passage of enabling legislation for every watershed in the state.

Minimum stream flow will have priority over inland lake levels.

The new watershed institution will have review and permit authority for new impoundment petitions.

The new watershed institution will have the following powers to collect revenue:

(1) a set fee from all property owners in the basin, based on a calculation of land area and use similar to that of Drain Commissioners. This would include road and highway area to be assessed to the authority managing the roads.

(2) a permit system replacing riparian "reasonable use." Permits would reflect the amount of water used and the cost of permit issue. Permits would also be given a priority status in order to establish appropriate usage during times of drought. All permits would be set in order to guarantee minimum flow rate.

Revenue not used to achieve compliance with federal, state, and sub-state regulations should be allocated by percentage to water quality issues deemed most important by the watershed agency and by voters. Examples are: wetland restoration, riparian tree planting, logjam removal, sediment remediation, fish stocking, environmental

education, land acquisition for public open space and recreation.

Additional powers to be considered by statute or vote include:

The ability to set and enforce standards for maximum non-erosive flows for all drains entering the receiving waters (flow rates within drains will be the jurisdiction of drain operators).

Review and permit authority for development in sensitive areas.

Mediation authority in intergovernmental disputes within the watershed upon request of both disputing parties.

Advisory authority in land use planning and conservation efforts.

Rouge River Watershed: Recommendations

The Financial and Institutional Arrangements Technical Advisory Group (F/I TAG) and the Rouge Program Office are considering a number of potential institutional options for the Rouge River Watershed. One component assisting both the F/I TAG and the Rouge Program Office to identify a range of possible institutional arrangements is a joint study undertaken by Apogee Research, Inc. of Maryland and Miller, Canfield, Paddock, and Stone - a law firm in Detroit with extensive financial experience in wastewater facilities. The Apogee/Miller Canfield effort resulted in a Final Report (Apogee Research, Inc., 1994) which identifies six (6) institutional alternatives designed to address coordination among communities and participation of multiple communities in decision making related to water pollution control infrastructures.

These approaches included the following:

a. Establish broader representation on sewer boards.
b. Establish rate arbitration board and/or arbitration procedures.
c. Address management issues at treatment facilities.
d. Establish common standards for adoption by locals.
e. Create a watershed planning authority.
f. Create an advisory regional authority.

The new groups cited above would not have operational responsibilities or enforcement capabilities.

Four (4) alternatives were identified that could be considered as means to address finance issues which arose during the study. These alternatives are as follows:

g. Share the credit capacity of strong credits.
h. Maximize the use of State Revolving Fund (SRF) funding.
i. Achieve regional financing through interlocal agreements.
j. Create finance authority to carry out regional financing approaches.

It is anticipated that the first two of these financing options would not have significant impact on Rouge River Watershed Communities. In contrast, the last two alternatives could have major impacts depending on certain upcoming decisions from state and federal regulatory groups.

The final group of options identified are those approaches which incorporate new arrangements for the management of water pollution control infrastructure in the Rouge River Watershed. Each of these alternatives envision creating an alternative institutional arrangement to the one currently in place for the management and operation of water pollution control infrastructure in the region. The options include the following:

k. Establish a public utility for sewerage services delivery.
l. Apply utility approach to create "wet weather utility".
m. Create drainage district for storm water management and/or corridor protection.
n. Create a regional sewerage authority.
o. Create a regional sewerage and storm water authority.

Certain of these alternatives would leave the current system for water pollution control in place but adding an entity to deal with issues not addressed by current programs. Other alternatives represent potentially very fundamental changes to the current system for water pollution control in the region (Apogee Research, Inc. 1994).

These alternatives and others we currently being considered. No recommendation for institutional changes have yet been made. It is anticipated that more detailed consideration of a limited number of options will take place in the near future.

Concluding Section

In concluding this paper, one should observe that there are incentives and benefits which should act to encourage the formation of watershed entities to function in new and more effective ways in the future. At the same time, one most also observe that certain barriers also exist which act to impede, delay, and de-rail innovative and needed changes. Finally, certain observations are included which

may be helpful to consider regarding performance characteristics of watershed entities.

Incentives: Watershed Approach

At first glance there appear to be a number of reasonable incentive activities which could encourage the formation of watershed entities. These incentives would include the following:

(a) Consolidate statutory grant programs to states (multi-purpose grants).
(b) Increase SRF rankings.
(c) More funds allocated for planning implementation.
(d) NPS Controls: Implemented on a time-line basis.
(e) Increase NPDES permit periods for Point Source Discharges.
(f) Single wet weather NPDES permits for specific watersheds.
(g) More flexibility, WQ standards - i.e., wet weather standards.
(h) Pollutant trading/wetland banking.

Benefits: Watershed Approach

As a consequence of watershed planning and management being undertaken through a holistic integrated fashion, one can reasonably expect certain benefits to occur. Consider the following:

(a) Effective functioning of ecosystems.
(b) Ecosystems not only function but flourish.
(c) A cost-effective system is in place to reduce adverse impacts on water bodies.
(d) Community commitment and potential for effective zoning law changes.

Barriers: Watershed Approach

Just as we recognize incentives and benefits with the implementations of the watershed approach, we must also recognize the realities of barriers which act to restrict, impede, and otherwise resist the implementation of such new approaches. Specific barriers identified to date include the following:

(a) Change.
(b) Threat to establish political power bases.
(c) Requires communication/cooperation across established political boundaries.
(d) Requires new prospectives on the nature of the problem: especially non-point source pollution.
(e) Requires effort to build and maintain trust among the multiple stakeholders with thewatershed.
(f) Requires exceptional efforts and energy to resolve conflicts and reach agreements which are beneficial within the watershed as a whole.
(g) Leadership: state/substate levels.
(h) Under the CWA, the watershed activities may be limited to water quality. Action(s)needed to be taken to expand to all aspects of water services - i.e., the 1974 model from England and Wales.
(i) Absence of federal legislative requirements: Need an alternative incentive to come together.

These barriers can and must be overcome. The nature of the problems requires indeed even compels the watershed approach. A variety of actions can be expected in the near future to encourage appropriate experimentation to achieve desired results in terms of a watershed entity. The observations which conclude this paper are offered for consideration by those who are consideration by those who are considering the nature and characteristics of such new institutions.

Concluding Observations

Characteristics which may useful for a watershed institution include but are not limited to the following:

(a) All costs and benefits should accrue within the watershed should be equitably distributed therein.
(b) The Watershed unit should have the power and authority to raise adequate capital and the flexibility to select the best means to secure funds and compel performance.
(c) The Watershed unit should have sufficient authority to resolve conflicts among stakeholders.
(d) The Watershed unit should have the legal and administrative authority to perform or caused to be performed the tasks needed in the specific watershed.
(e) Lines of communication and the process of coordinating planning and management should be formalized.
(f) The Watershed unit needs to be accountable to the public including the decision-making process.
(g) The Watershed Unit should be compatible with the overall governmental structure.
(h) There should be sufficient incentives to encourage local governmental units to join into this new partnership organization.
(I) The Watershed area should be large enough to realize economies of scale.
(j) The Watershed unit should be able to consider and adjust externalities arising from the system.
(k) The Watershed unit should be capable of assuring compliance with the provisions of the Clean Water Act (Moon, 1995).

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Combined Sewer Overflow Abatement Projects
Rouge River National Wet Weather Demonstration Project

Community	Control Option	Total Project Cost*	Federal Grant Share	Area
Village of Beverly Hills City of Birmingham Acacia Park	Basin	$13,750,000	$6,954,810	816 Acres
City of Bloomfield Hills	Basin	$2,435,000	$633,950	86 Acres
Bloomfield Village	Separation	$28,850,000	$13,908,700	2325 Acres
City of Birmingham	Basin	$35,661,500	$16,969,700	1185 Acres
City of Dearborn	Tunnel	$56,725,530	$30,244,500	2057 Acres
City of Dearborn Heights	Basin	$24,420,990	$13,671,840	340 Acres
City of Detroit Hubbell-Southfield	Basin	$63,000,000	$31,778,450	14,400 Acres
City of Detroit Puritan-Fenkell	Basin	$22,000,000	$10,589,370	649 Acres
City of Detroit Seven Mile	Basin	$16,500,000	$10,612,550	463 Acres
City of Garden City	Separation	$29,913,140	$12,166,460	960 Acres
City of Inkster	Basin	$24,390,990	$11,965,220	833 Acres
City of Livonia	Separation	$1,496,000	$744,210	103 Acres
Plymouth Township	Separation	$1,223,000	$673,410	163 Acres
Redford Township	Basin	$19,688,960	$9,809,900	551 Acres
City of River Rouge	Basin	$28,753,240	$14,170,990	930 Acres
City of Wayne	Separation	$18,919,280	$9,539,620	288 Acres
City of Westland	Separation	$9,706,000	$4,783,360	409 Acres
TOTAL		**$397,433,630**	**$199,227,040**	

*Includes design costs

TABLE 1