United States
Environmental Protection
Agency

Municipal Environmental Research
Laboratory
Cincinnati OH 45268

Research and Development

EPA-600/S5-82-001 August 1982

EPA

Project Summary

Socioeconomic Impacts of Water Quality Strategies

Robert F. McMahon

This report provides a set of methods and techniques for considering socioeconomic impacts in the water quality planning process. Socioeconomic impacts considered include those in the following impact categories: fiscal effects, employment effects, individual costs and benefits, land use and growth effects, public service impacts, sensory impacts, public health effects, and historic resource impacts. These types of impacts have typically not been given adequate consideration in water quality planning.

The report is divided into two parts. Part 1 presents a prototypical socioeconomic impact assessment process and guidelines for integrating it into the overall water quality planning process. Four assessment activities are discussed in the context of water quality management planning: impact identification, impact measurement, impact evaluation, and impact mitigation. Techniques for each of these activities are discussed and examples presented. A particular emphasis of the report is on evaluating alternatives rather than on assessing the impacts of a "best" alternative. The types of water quality strategies discussed in Part 1 include conventional and alternative wastewater techniques, stormwater management controls, hydrographic modifications, water conservation controls, industrial wastewater controls, growth management controls, and other non-point source controls.

Part 2 considers techniques for estimating the impacts of water quality controls for the above impact categories. Socioeconomic issues, impact indicators, and measurement techniques are presented for each impact category.

This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Since its inception in 1969, the National Environmental Policy Act has called for the socioeconomic effects of the water quality planning process to be assessed. Despite this mandate, socioeconomic impacts have received spotty attention in the environmental assessments and in impact statements that accompany wastewater facilities plans and areawide water quality planning efforts. Increasingly, however, socioeconomic issues, such as the effects of land use and user charges, have influenced the public acceptance of water quality strategies. Typical socioeconomic issues associated with water quality strategies are shown in Table 1.

The purpose of this report is to provide water quality planners with methods and techniques for considering socioeconomic impacts in the water quality planning process. Although the report was originally designed to provide guidance for areawide water quality management planning, it is also relevant to sewerage planning done under the Section 201 construction grants program.

Water Quality Strategies

One of the main purposes of the background research supporting the development of the report was to develop an understanding of how socioeconomic

Table 1. Representative Socioeconomic Issues in Water Quality Management Planning

Employment and Economic Growth

- *increase in construction-related employment for pollution control facilities*
- *locational shift of businesses*
- *increase in employment for operation and maintenance of pollution control facilities*
- *increase in employment for administration, planning, and management of pollution controls*

Public Fiscal Costs

- *increase in capital, operation, and management costs related to public pollution controls*
- *increase in revenue from pollution control charges and fees*
- *increase in regulatory costs related to private pollution controls*

Land Use

- *pre-emption of land for pollution control facilities*
- *changes in site design*
- *changes in use of existing built environment and land uses environment and land uses*
- *changes in growth pattern (timing, amount, locations, and type of growth)*

Public Health/Safety

- *impacts associated with operation of pollution control facilities involving hazardous wastes*
- *impacts associated with improved water quality for drinking and recreational uses*
- *impacts associated with strategies that offer multiple benefits in terms of flood prevention, erosion control, environmental sanitation*
- *impacts associated with malfunctioning of pollution control facilities*

Private Cost and Benefit Incidence

- *increase in pollution abatement costs for firms,developers*
- *increase in homeowner user charges*
- *increase in property taxes*
- *increase in special assessments*
- *increase in real estate values*

Other Public Services

- *change in water consumption demands*
- *change in water supply availability*
- *change in solid waste management*
- *change in storm drainage management*
- *change in street maintenance*

Visual

- *conflicts in fit-with-setting*
- *conflicts with visual identity*
- *visual nuisances*
- *conflicts with views and vistas*
- *changes in natural elements*

Historic Resources

- *changes in the number, type, location, use, and character of historic, archaeological, and architectural resources*

Recreation

- *changes in recreational opportunities*
- *changes in recreational demand*

impacts—both direct and indirect—occur from water quality strategies. The report divides water quality strategies into three component parts:

- Physical controls or management practices
- Implementation measures
- Institutional arrangements

Physical controls or management practices are physical actions that modify or reduce pollutants. Controls include not only end-of-the-line approaches such as treatment plants but also any physical activity that modifies the physical generation of wastes in the waste stream process. Four general types of physical controls in water quality management are: reduction of waste generation; modification of wastes after generation in on-site, collection, or final treatment facilities; redistribution of wastes from one receiving media to another; and alteration of the assimilative capacity of the receiving media. Physical controls may range from simple management practices such as contour plowing used in agricultural erosion control to advanced wastewater treatment plants.

A variety of features of physical controls stimulate impacts:

- Physical features
- Capacity
- Resource inputs
- Physical by-products
- Construction activities
- Operating characteristics

Location is a unique issue that shapes each of the above characteristics in stimulating impacts. Certain features such as construction activities may not have any socioeconomic effects, but when combined with location, construction activities may affect historic resources or produce sensory impacts for an adjacent area.

Implementation measures are the incentives or inducements that precipitate or spur an action. For physical control actions to take place, they must have some type of trigger to ensure their implementation. These implementation measures may take a variety of forms, such as sewer use charges, sediment control ordinances, operation and maintenance manuals, or zoning by-laws. They may be regulatory, enforcement, economic, or educational in nature.

Not only will implementation measures influence the effectiveness of control strategies, they will also stimulate socioeconomic impacts. Regulatory and economic incentives have the most potential for stimulating impacts. For example,

stormwater control ordinances, pretreatment ordinances, erosion control ordinances, and sewer surcharges—all of these generally induce private sector compliance costs as well as public fiscal administrative costs.

Institutional arrangements, the third component of a water quality strategy, encompass the institutions and arrangements to manage and finance a water quality strategy. The type and distribution of socioeconomic impacts associated with institutional arrangements will depend on the following factors:

- The number and type of management responsibilities to be performed;
- The distribution of responsibilities;
- The methods used to finance public control strategies and to finance implementation measures.

Obviously, the greater the number of management functions to be performed by a public agency, the greater the potential for increased public expenditures. The size of the impact, however, will be affected by public/private sector distribution of responsibilities and by the geographic distribution of responsibilities among agencies. Public finance mechanisms represent a means of further distributing public costs to the private sector—to firms and individuals.

The above factors help explain how direct socioeconomic impacts occur from water quality strategies. Indirect impacts are those stimulated by direct impacts. For example, a water quality strategy that imposes erosion controls on farmers might change the farmer's production costs, or crop income, or both. These direct cost and revenue changes might, in turn, stimulate the impact chain shown below:

Agricultural Erosion Controls → Changes in Production Costs and Revenues → Changes in Land Values → Conversion of Land to Developed Uses → Changes in Housing Supply → Changes in Population

The impact chain could, of course, go on further as population changes may trigger changes in public service demand, employment, land use, recreational opportunities, etc. The likelihood and magnitude of indirect impacts depend on the likelihood of the preceding impact and on the context of the impact area.

The report outlines in summary form direct and indirect socioeconomic issues for the following types of water quality control strategies:

- Conventional centralized wastewater treatment systems
- On-site and alternative wastewater treatment systems
- Residuals management
- Hydrographic modifications
- Infiltration/inflow and combined sewer controls
- Water conservation controls
- Industrial wastewater controls
- Urban stormwater source controls
- Urban stormwater flow attenuation controls
- Urban stormwater storage treatment controls

Measurement Techniques

A large portion of the report is devoted to techniques for measuring the effect of the following 10 socioeconomic impact categories:

- Public fiscal
- Private individual costs and benefits
- Private firm costs
- Employment and economic growth
- Land use, housing, and population
- Other public services
- Recreational opportunities
- Historic resources
- Sensory
- Public health and safety

There is a chapter for each of these impact categories, and each chapter covers the following topics: impact description; impact indicators; preliminary considerations; measurement techniques; data sources; and references. Numerous examples and checklists highlight the discussion of the impact measurement techniques. Two examples are shown in Figure 1 and Table 2, and a typical checklist is shown in Table 3.

In addition to presenting specific impact measurement techniques, the report presents a step-by-step process for doing *all* aspects of a socioeconomic assessment. Socioeconomic assessments consist of four activities: impact identification, impact measurement, impact evaluation, and impact mitigation. The steps involved in doing these four modular activities are summarized in Figure 2. Suggested techniques and alternatives for performing these activities are presented in the report.

The full report was submitted in fulfillment of Contract No. 68-03-2618 by Urban Systems Research and Engineering, Inc., under the sponsorship of the U.S. Environmental Protection Agency.

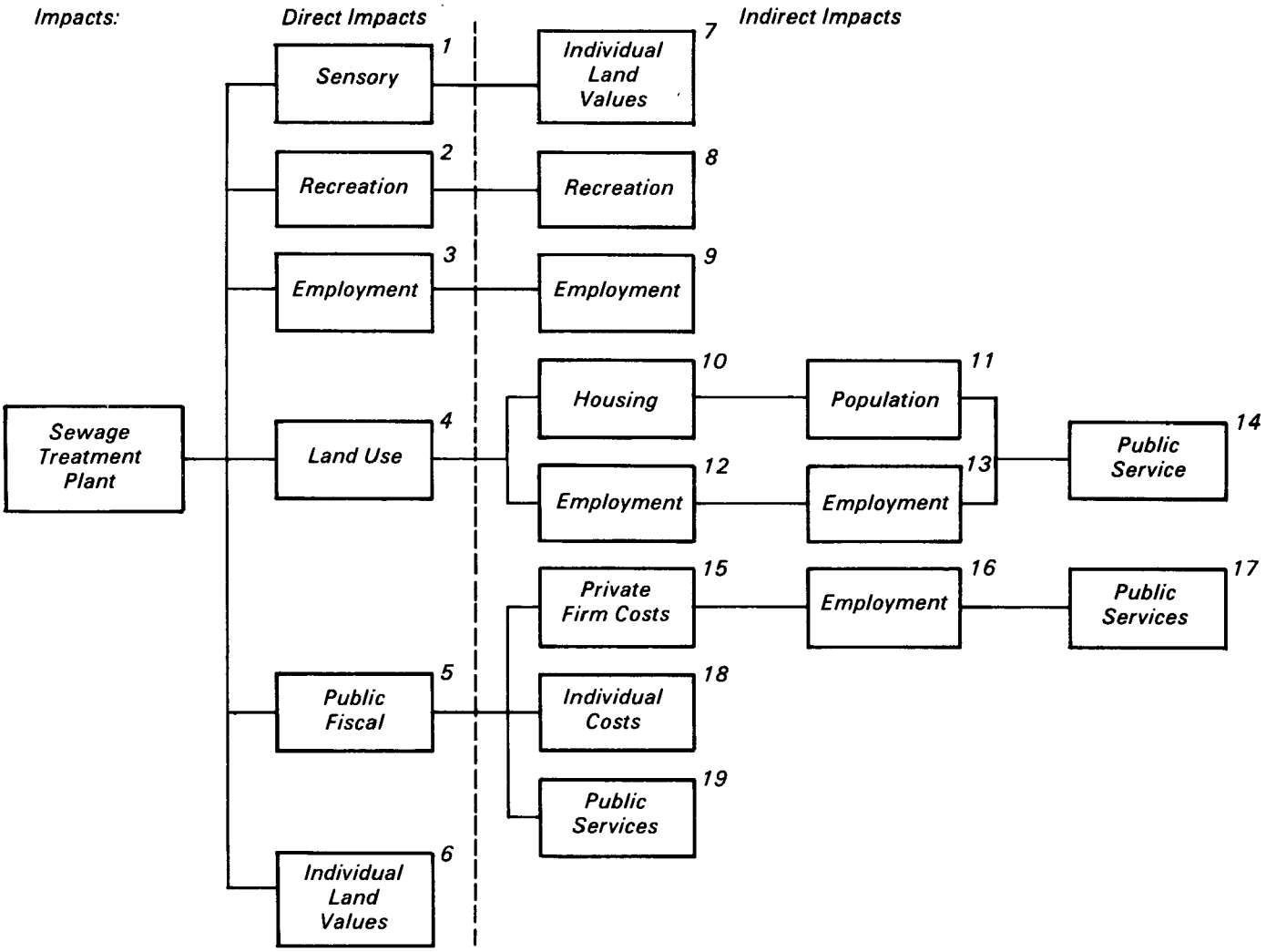

Figure 1. *Direct and indirect impacts associated with a sewage treatment facility in Smithville. Background: Smithville is a small bedroom community of 5,000 located along Interstate 24 about 20 miles south of Center City. Because of poor soils that limit development with on-site wastewater systems, the town is considering its first sewage treatment facility. About 2,000 of the town's residents will be served by the first phase of the project. Local capital costs for the project will be financed by long-term general obligation bonds that will be paid off by property taxes, benefit assessments, and user charges. Local capital costs will total $3 million. The only two industries in town, two leather tanning firms, presently discharge to the North River. The proposed plan calls for them to discontinue their present direct discharges of tanning wastes and to pretreat their wastes and tie into the new advanced sewage treatment plant. Because of a shortage of sites along the North River, the plant will be built in an area characterized by large-lot single-family homes. 1. Sensory = increased visual and noise nuisances. 2. Recreation = loss of public access to boating and canoe launching area. 3. Employment = increase in construction-related and operational employment associated with the plant. 4. Land use = increase in developable residential land in the southern part of town and commercial land around Interstate 24 highway interchange. 5. Public fiscal = increase in capital and operational costs associated with public sewerage. 6. Individual land values = increases in property values of proposed sewered land. 7. Individual land values = decrease in land values in the area surrounding the treatment plant. 8. Recreation = increase in demand on other riverfront public boat and canoe areas. 9. Employment = increase in multiplier service-related employment. 10. Housing = increased number of housing units; changes in single-family/multi-family mix in town; and increased rate of development. 11. Population =increased population and rate of growth. 12. Employment = increase in commercial and construction employment. 13. Employment* = increase in multiplier service-related employment. 14. Public services = *changes in public services demand. 15. Private firm costs = changes in wastewater costs and tax burdens for firms connected to municipal systems. 16. Employment = decreases in local manufacturing employment. 17. Public services = change in water consumption demand. 18. Individual costs = changes in wastewater costs and taxes. 19. Public services = changes in proposed water supply facilities construction.*

Table 2. *Effect of a New Sewage Treatment Facility on Employment of Construction Workers*

Facility Cost = $77.9 million

Assumptions:

- *skilled labor accounts for 25% of total cost*
- *unskilled labor accounts for 40% of total cost*
- *skilled labor = $15/hour*
- *unskilled labor = $10/hour*
- *person-year = 2000 person-hours*

Dollar value of skilled labor = $77,900,000 x .25 = $19.5M

Dollar value of unskilled labor = 77,900,000 x .40 = $31.1M

Level of effort of skilled labor = 19,500,000 ÷ $15/M ÷ 2000 hours =
19,500,000 ÷ $15/M ÷ 2000 hours650 person-years

Level of effort of unskilled labor = 31,100,000 ÷ $10/M ÷ 2000 hours =
19,500,000 ÷ $15/M ÷ 20001555 person-years

Total labor = 2205 person-years

Assumptions:

- *construction period = 10 years*
- *construction season is 6 months (0.5 year)*

Therefore: 2205 person-years ÷ 10 (.5) actual construction time =
440 people employed during the construction period for 10 years

Table 3. *Suggested Checklist for Visual Impacts*

Visual Impact Factors	Component	Questions
1. Fit with Setting	Massing	Are the height, bulk, setbacks, site coverage and open space patterns of project design compatible with that of the surroundings, especially at project edges?
	Form	Do major elements of architectural form—roofline, solid/void relationship, windows, etc., correspond to those of the project's surroundings?
	Surfaces	Are the colors, textures and materials of the project surfaces comparable to those of the surroundings?
2. Visual Identity	Character	Will the proposed facility constitute a compatible land use in the community; will it encourage an increase in the rate and extent to which undeveloped land is converted to urban uses?
3. Views and Vistas	Sightlines	Does the facility design respect sightlines from public areas to views valued by the community?
	Vantages	Does the facility design conserve a valued vantage point on-site from which views are traditionally enjoyed, or does it create one?
	Vistas	Is the facility as a whole compatible with its setting where seen from afar? Will it encourage development that is compatible?
4. Visual Nuisances	Physiological Comfort	Does the facility provide conditions favorable to the ease and comfort of sight (no glare, shadows, flashing lights, etc.)?
	Physiological Comfort	Does the facility eliminate or screen visual nuisances or eyesores?
5. Natural Elements	Conservation	Does the strategy encourage the conservation or preservation of existing topography, vegetation, etc.?
	Landscaping	Does the control strategy provide or encourage the use of new natural features (i.e., planting shrubs, trees, grass, etc.)?

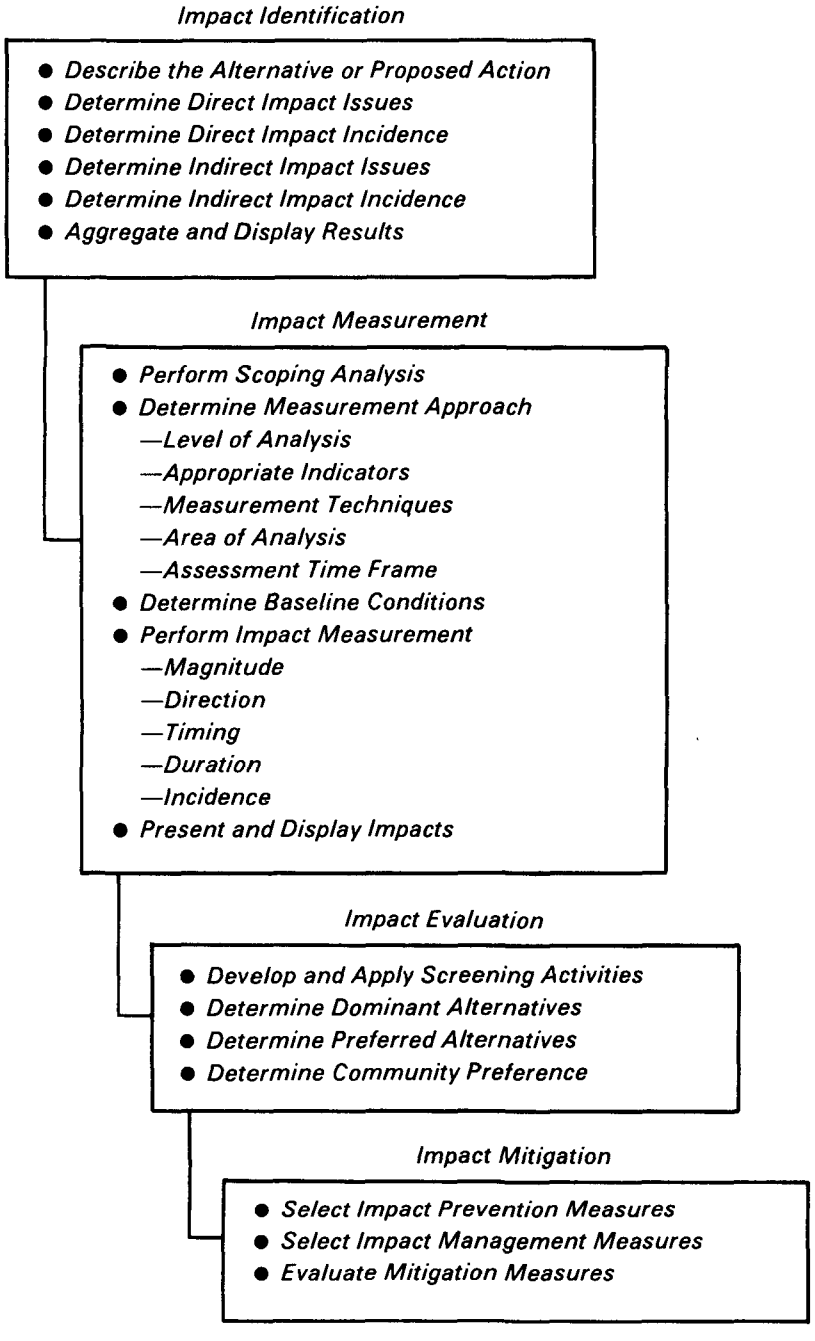

Figure 2. *Socioeconomic assessment activities.*

☆U. S. GOVERNMENT PRINTING OFFICE: 1982/559-092/0458

Robert F. McMahon is with Urban Systems Research and Engineering, Inc., Cambridge, MA 02138.
***Don C. Niehus** and **Frank Evans** are the EPA Project Officers (see below).*
The complete report, entitled "Socioeconomic Impacts of Water Quality Strategies," (Order No. PB 82-222 894; Cost: $31.50, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
*For information, **Don C. Niehus** can be contacted at:*
Facilities Requirements Division
Office of Water Programs
U.S. Environmental Protection Agency
Washington, DC 20460