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Evaluation of a Planning Methodology: Integrating Land Use Information in Water Quality Planning

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EVALUATION OF A PLANNING METHODOLOGY: INTEGRATING LAND USE INFORMATION IN WATER QUALITY PLANNING

by

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Matthew B. Conover

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KEY TERMS DEFINED

Some terms repeatedly appear in planning literature with little or no definition. Due to the complexity of this subject, it is important that definitions be understood early in the paper, rather than in a glossary at the end. For this paper the following definitions apply:

ANALYSIS: Detailed systematic investigation of the operating mechanisms and structural variables which may affect the stability of a system. Analysis includes the investigation of critical and threshhold factors, limiting factors, trigger factors, etc. Analysis is one stage in the overall planning methodology. Other stages are defined in planning models discussed in the literature review of methodologies.

EVALUATION: A review for the purpose of determining adequacy according to some specified criteria. Can be conducted to evaluate a physical, conceptual, or administrative system.

MANAGEMENT PLANNING: The tasks required to establish institutional arrangements for plan implementation. These include the following:

- Selection of a management agency for implementation
- Identification of institutional and legal problems
- Analysis of legal and fiscal capabilities

- Screening of alternative mechanisms and plans for feasibility and public acceptance
- Helping to select a final plan

METHOD: A systematic approach to applying procedures and techniques of analysis to understand a system. A method is more detailed and specific than a methodology. A methodology may consist of a package of methods, arranged in sequence to order the component analyses by various staff members.

METHODOLOGY: The systematically designed package of methods, activities, information requirements, and intermediate products which provides guidance to a planning staff. The methodology is usually designed by the project manager to guide the work of the staff. It should be more than a set of tasks, in that it should provide sequence and order to achieve a desired end product. The term is used here as a replacement for the term "planning process", which has created confusion in the past with other more appropriate applications of the word "process."

PROCESS: The evolution of change in the condition of a system, e.g., biological process or geological process or urbanization process. These are usually the subjects of planning studies, and should not be confused with the purposeful design of planning activities connoted by "methodology."

PROGRAM: A set of activities forecasted for a region. The program statement established by a client describes the magnitude and

character of expected development. It may be described in terms such as population in-migration, number of houses by type and density, size and type of public facilities, and acreages required for each land use category. Other indicators may also be used. The use of this term does not preclude the traditional use of "program" to refer to an agency program in an area.

PROJECT MANAGEMENT: The activities required to coordinate and supervise completion of a project, including the following:

- designing the methodology
- specifying methods and procedures to be used by staff
- ensuring consistent assumptions, connectable methods, timely sequencing of component analyses, and timely distribution of intermediate products
- reviewing the logic and quality of intermediate and final products
- other duties normally associated with a project director

TECHNICAL PLANNING: The technical engineering, economic, planning and analysis activities required to prepare a functional plan, such as the following:

- identification of specific technical problems
- inventory of water quality conditions
- modeling stream and land use conditions
- formulating projections

- assessing impacts
- formulating alternative technical plans and their respective elements
- surveillance and monitoring
- evaluation of plans by pre-specified criteria

ABSTRACT

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by

Matthew B. Conover, Master of Science

Utah State University, 1980

Major Professor: Dr. Richard E. Toth
Department: Town and Regional Planning

The case study investigated was the 208 water quality planning conducted in the Ashley Valley, around Vernal, Utah. The region is expected to urbanize rapidly due to energy development on adjacent state and federal land. The water quality planning was being conducted in the absence of substantial prior land use planning.

A method is developed in the thesis for evaluating plans and methodologies. The method utilizes preformulated evaluation criteria to analyze structure and function of the methdology, political context, informational inputs, limiting factors, trigger factors, cause-effect relationships, and impacts of methodology on planning recommendations. The criteria collected from the literature and agency guidelines are consolidated into an evaluation model. Data were collected through field interviews, on-site inspection, and examination of workplans, critical path charts and plan documents.

The planning was well conducted overall. However, the water quality planning methodology did not maximize the utilization of land use information, nor did it ingegrate the available land use information into the analysis as fully as possible. Utilization of land use information could have been increased through greater emphasis on land use in the original workplan, more guidance to staff through specification of land use analysis subtasks, tighter coordination of staff, and consideration of a broader range of alternative scenarios.

The cursory nature of the land use analysis limited the number of alternative land use patterns identified. This in turn limited the number of potential pollution sources identified. The local political context discouraged serious consideration of some alternative land use patterns, and the use of land use controls as a management strategy.

(154 pages)

CHAPTER I

INTRODUCTION

Need for Evaluations

With recent increased activity in planning for land use, water quality, energy development and a variety of other sectors, planning products have proliferated. The number of plans needing coordination has given rise to a need for rapid evaluation of plans and intermediate products by program administrators, local government managers, affected members of the public and planners on related projects.

Part of a total evaluation of a plan is the analysis of its methodology. Methodology provides the framework within which information is collected, choices are identified and evaluated and plan recommendations are developed. An evaluation of methodology can, therefore, provide the evaluator with an improved understanding of the assumptions, logic and information used to develop plan recommendations and a check on any potential shortcomings in the logic sequence.

Planning project managers are responsible for the designing the methodology for a new planning project. Evaluations of the methodologies used on other projects can give them an understanding of the analytical shortcomings of other projects and thereby help them to avoid similar pitfalls in designing their own methodology.

Therefore, methodology evaluation is an important project management skill.

This thesis was prepared to help the author develop evaluation skills and to improve skills of methodology design. The case study was prepared in order to develop an indepth understanding of the evolution of a single planning project, and the influence of the context and methodology on the plan results.

Background

The case study investigated was the Areawide Water Quality Management Plan prepared by the Uinta Basin Association of Governments and its consultants. The water quality planning was authorized under the Federal Water Pollution Control Act Amendments of 1972, and administered by the U.S. Environmental Protection Agency. The Uinta Basin Association of Governments is a council of governments (COG) consisting of city and county governments.

Ashley Valley is the part of the Uinta Basin which lies at the southern base of the Uinta Mountains along the border of Utah, Colorado, and Wyoming (see Figure 1). Oil shale development is expected to cause rapid urbanization and attendant changes in land use patterns and water quality. Downstream impacts could be created, since the valley is located in the headwaters of the Green and Colorado Rivers.

Areawide water quality planning is for non-point sources of pollution, in contrast to the point source pollution discharged at

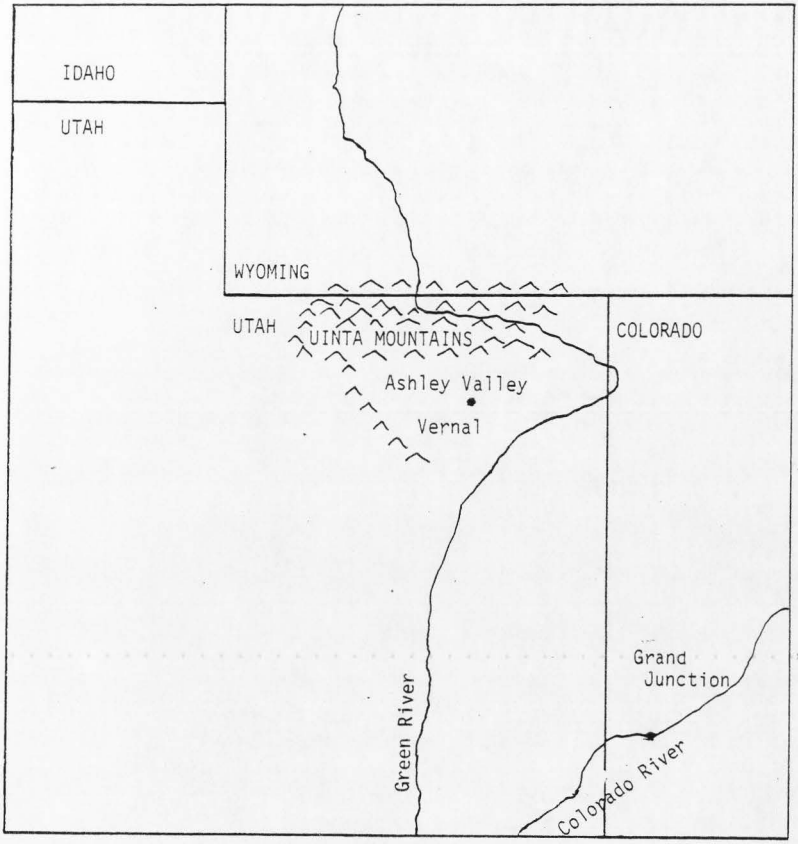

Figure 1. Regional location of study area.

pipe outfalls associated with industrial plants. Agricultural and urban runoff are examples of non-point source pollution. The Ashley Valley has substantial agricultural land, as well as mineralized deposits and a growing urban surface. Therefore, land use patterns and the methods by which the patterns are projected are an important aspect of the water quality planning evaluation.

The evaluation was limited to the Ashley Valley because the author was most familiar with the area from a prior study at the time the 208 planning was getting started.[1] The purposes of the two studies were very similar, providing a basis for comparison. Subsequent studies by other outside parties have provided further basis for comparison. The preparation of the water quality management plan was monitored, and the final documents at the end of the two-year preparation period were reviewed. This case study, is therefore, based on a combination of on-site experience and an analytical review of the intermediate and final products.

The Water Quality Management Plan was prepared between 1975 and 1977 by both UBAG and its water quality planning consulting firm. The consultant contracted for data collection and plan preparation. Assistance was to be provided on the land use analysis by UBAG staff.

In some part of the Uinta Basin, land use planning regulations had been almost completely eliminated after changes in planning

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[1] See Bishop, et al, "Environmental Quality Management in a Region with External Development Pressures." (Logan, Utah: Utah Water Research Laboratory, 1977), p. 144.

commission membership. In the Ashley Valley, however, Vernal City had recently been enacting fairly strict controls, such as moratoria on water and sewer hookups and new construction. It was not clear to what extent land use analysis and data would be effectively integrated into the water quality planning.

Since the water quality plan had not yet been prepared, the proposed methodology was examined to determine whether land use was contemplated for indepth analysis. The work plan summary and critical path chart appeared to give land use only incidental mention. When the Preliminary Land Use Report was produced by UBAG staff, the report seemed brief and lacking in depth. Subsequent documents did not contain much additional land use analysis. This led to a perception by the author that the water quality planning was not effectively integrating land use and water quality planning. This thesis describes the subsequent evaluation and the method by which the evaluation findings were reached.

It is important that the reader recognize at the outset that the water quality plan was prepared for the most part by professional water quality engineers, and that their work has since been well received by municipalities and agencies. This evaluation has been conducted from a land use planning perspective. Accordingly, recommendations have been made as to how the methodology and planning recommendations could be made more effective from the land use planning perspective.

Documents reviewed included the 1970 Uinta County Comprehensive Plan, the 1970 Vernal City Comprehensive Plan, the 1975 Vernal City Water and Sewer Plan, the charter of the Uinta Basin Association of Governments, the 1974 UBAG 208 Program Proposal, the UBAG 208 Work Program, the 1975 UBAG Preliminary Land Use Report, the 1977 Water Quality Management Plan and intermediate technical reports. The information gathered from these reports included the methodology used in the planning, the criteria used for formulating recommendations and the substance of the recommendations.

Purpose and Objectives

The purpose of this thesis was to determine whether the methodology and context affected the quality of the planning products in the water quality planning of the Ashley Valley. Related objectives of the study were the following:

1. To determine if the methodology encouraged or discouraged integration of land use information.
2. To analyze the extent of utilization of land capability data in the land use analysis stage.
3. To determine if project management practices might have influenced how the methodology was put into practice.
4. To recommend improvements in the water quality planning methodology to better integrate land use information.

Research Design

A case study was prepared describing the political context methodology and planning recommendations. An evaluation model was developed based on criteria from several sources. The criteria were translated into a series of questions and answers were developed based on information from interviews, documents and related studies. The most significant answers were reported as a set of findings. Supporting evidence, recommendations and examples were attached to each finding. The evaluation method developed provides a rational and consistent approach for other indepth reviews by governmental planning agencies.

The research involved the following steps:

1. A literature review of professional planning evaluation criteria.
2. A review of planning methodology sequence models.
3. A review of legislative and administrative guidelines for water quality planning.
4. Field trips to interview planners and managers and to examine physical conditions at sites having potential for water quality or land use problems.
5. Readings of related studies on the area's land use, water quality and economic development potential.
6. Examination of work plans and critical path charts to document methodology.

7. Analysis of products and methodology, using the criteria in the evaluation model.

Assumptions

Three important assumptions underlie this approach:

1. Planning methodology can influence the quality of planning products.
2. Water quality planning studies should follow the same sequence and practice as planning studies for other subject areas.
3. Land use information is important for good water quality planning and the two should be well-integrated to foster more effective water quality planning.

CHAPTER II

LITERATURE REVIEW OF EVALUATION METHODS

Introduction

The two fundamental approaches available for evaluation studies are the hypothetico-deductive and the holistic-inductive approaches. The hypothetico-deductive approach is based on hypothesis testing, using experimentation and statistics. However, quantitative approaches are difficult to apply to evaluations of methodology because it is almost impossible to develop accurate quantitative measures of the effects of methodology on the quality of planning products. Examples of other applications of the quantitative approach are available in Evaluation: A Systematic Approach, by Rossi, et al.[1]

The alternative approach is the holistic-inductive style, which emphasizes qualitative analysis in case studies. Techniques include open-ended interviewing, detailed descriptions, personal observations, and close contact with the subject of study. Patton, in Utilization-Focused Evaluation,[2] advocates the holistic-inductive approach because it emphasizes (1) the process by which planning results were obtained, (2) the usefulness of planning products to user groups, and (3) appropriateness of planning techniques used.

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[1]Peter H. Rossi, Howard E. Freeman and Sonia Wright, Evaluation: A Systematic Approach (Beverly Hills, Sage Publications, 1979) p. 336.

[2]Michael Quinn Patton, Utilization-Focused Research (Beverly Hills, Sage Publications, 1978), p. 204.

While the holistic-inductive paradigm is subjective and, therefore, subject to bias, Patton emphasizes that, "It is participation in an activity that generates interest, purpose, point of view, value, meaning, intelligibility, as well as bias." He stresses that the holistic-inductive approach does not limit the ability of the researcher to be scientific. Patton says the holistic-inductive paradigm is appropriate for the evaluation of planning methodology because the researcher should investigate the internal dynamics and actual operations--how parts fit together, why things are happening. The approach emphasizes the need to know how a plan is produced as much as the content of the plan.

> The evaluation is process-oriented. Process evaluation is built on subjective inferences. Process evaluation requires getting close to the data, becoming intimately acquainted with the details of a program. Thus, process evaluation includes a holistic orientation to evaluation research.[1]

However, he also says that process evaluation is part of a "total model" consisting of analysis of the context, data inputs, process and products.

Patton identifies the major steps of a process evaluation method as follows:

1. Gather data to detect or predict defects in procedural design or its implementation.
2. Obtain information for program decisions.

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[1]Ibid, p. 165

3. Establish a record of program development as it occurs. The techniques to apply this method include participant observation, indepth interviewing, detailed description, and qualitative field notes.[1]

Fink and Kosecoff[2] distinguish between evaluations of effectiveness and evaluations of the potential for improvement. An improvement evaluation would appear to be the same as the approach suggested by Patton, that of detecting defects in the procedural design or plan recommendations. Fink and Kosecoff concur that the case study constitutes an appropriate research design.

Starling[3] has provided a list of procedures for conducting a case study:

A. Determine significant issues.

B. Determine what other information would be desirable and how it might be obtained.

C. Determine assumptions and biases.

D. Assess in what other ways the data could be presented.

E. Identify action alternatives.

F. Evaluate alternatives on the following base:

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[1]Ibid., p. 208

[2]Fink and Kosecoff, An Evaluation Primer (Washington, D.C., Capitol Publications, 1978).

[3]Grover Starling, The Politics and Economics of Public Policy: An Introductory Analysis with Cases. (Homewood, IL., Dorsey Press, 1979) pp. 519-520.

1. Benefits, costs, and risks
2. Distribution of benefits
3. Implementation feasibility

G. Make recommendations.

Methods Used in This Study

The holistic-inductive approach was applied in this thesis to conduct a combined evaluation, mixing evaluations of context, inputs, process and product. The emphasis of the thesis is on process (called methodology), so the thesis follows Patton's suggestion of gathering data to detect defects in procedural design. The case study includes several of the steps and techniques suggested by Patton and Starling.

In order to analyze UBAG's planning context, inputs, procedural design and products, the overall question was asked: "How could the UBAG 208 planning have been improved?"

The research method consisted of the following:[1]

I. Problem Formulation

A. Surveys, printed reports, related documents, and interview notes to determine significant issues.

B. Issues listed

C. Described the context, site, and program, in order to determine the external forces (economic, political and physical) which might influence the methodology and

[1]Adapted from the method suggested by Toth in "An Approach to Principles of Land Planning and Design," Cambridge, Mass., 1975 (mimeographed).

and planning recommendations. (This was done to determine potential assumptions and biases.)

II. Inventory and Data Collection

A. Held interviews with staff planners and resource managers at the local and regional level.

B. Worked closely with the State Planning Coordinator's Office in a review of alternative future scenarios, as well as locational criteria for new economic activities and facilities.

C. Researched and identified siting criteria for specific land use expected in the region, and identified alternative sites for those facilities. Identified alternative land use patterns that could occur as a result of alternative policies, events, and siting decisions.

D. Reviewed reports and interview notes to document the methodology used by UBAG staff and consultants, including the criteria used for formulating recommendations and the substance of recommendations.

E. Field observations were used during data collection trips to assess suitability of sites for urban land uses, confirm site descriptions in reports, determine recent residential development, and judge the probability of future development.

III. Criteria Formulation

A. Evaluation criteria found in the literature were consolidated into an evaluation model.

B. Additional criteria were formulated by the author, based on the author's experience in other professional planning evaluations.

IV. Analysis

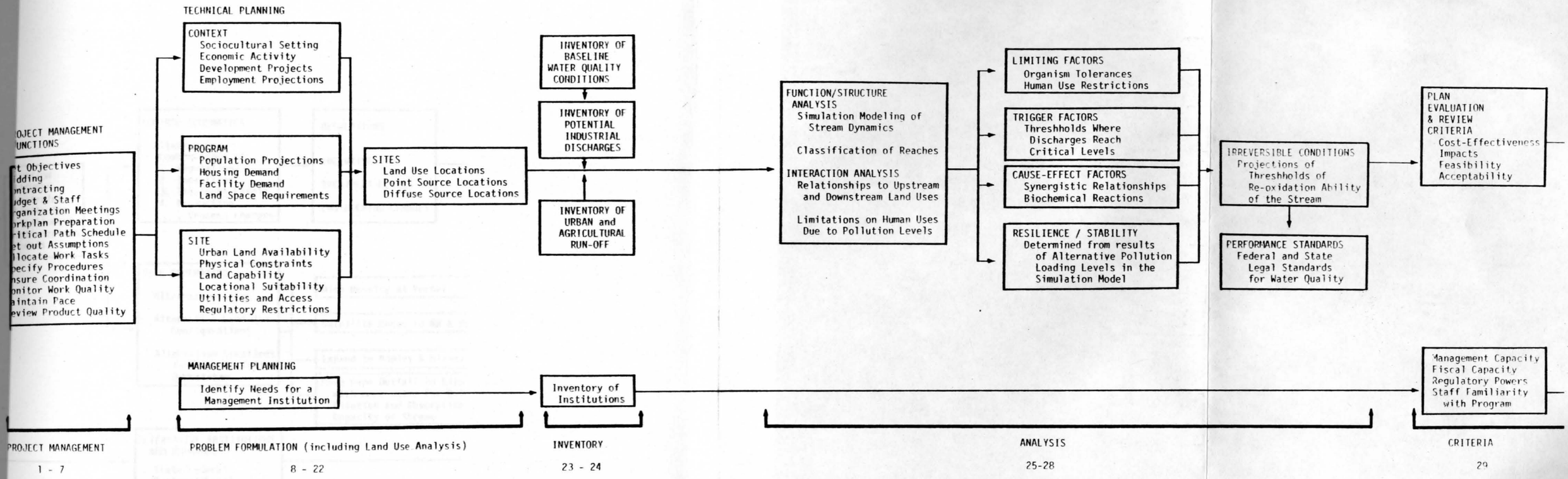
A. The case study methodology was classified through:

1. "horizontal sorting" of the major stages of the methodology, and

2. "vertical sorting" between technical planning and management planning. (The results of this classification sorting are shown in the flow diagrams of Figures 2 and 3.)

B. Structure Analysis--The major structural stages of the methodology were interpreted from flow diagrams. This allowed further evaluation of missing structural elements, informational inputs, and feedback linkages (see Figures 2 and 3).

C. Function Analysis--The functioning of the water quality planning methodology was analyzed using the flow chart diagrams. The function analysis consisted of the following steps:


OJECT MANAGEMENT
UNCTIONS
t Objectives
dding
ntracting
dget & Staff
ganization Meetings
rkplan Preparation
itical Path Schedule
t out Assumptions
llocate Work Tasks
pecify Procedures
nsure Coordination
onitor Work Quality
aintain Pace
eview Product Quality
TECHNICAL PLANNING
CONTEXT
Sociocultural Setting
Economic Activity
Development Projects
Employment Projections
PROGRAM
Population Projections
Housing Demand
Facility Demand
Land Space Requirements
SITE
Urban Land Availability
Physical Constraints
Land Capability
Locational Suitability
Utilities and Access
Regulatory Restrictions
SITES
Land Use Locations
Point Source Locations
Diffuse Source Locations
INVENTORY OF BASELINE WATER QUALITY CONDITIONS
INVENTORY OF POTENTIAL INDUSTRIAL DISCHARGES
INVENTORY OF URBAN and AGRICULTURAL RUN-OFF
FUNCTION/STRUCTURE ANALYSIS
Simulation Modeling of Stream Dynamics
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Limitations on Human Uses Due to Pollution Levels
LIMITING FACTORS
Organism Tolerances
Human Use Restrictions
TRIGGER FACTORS
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Biochemical Reactions
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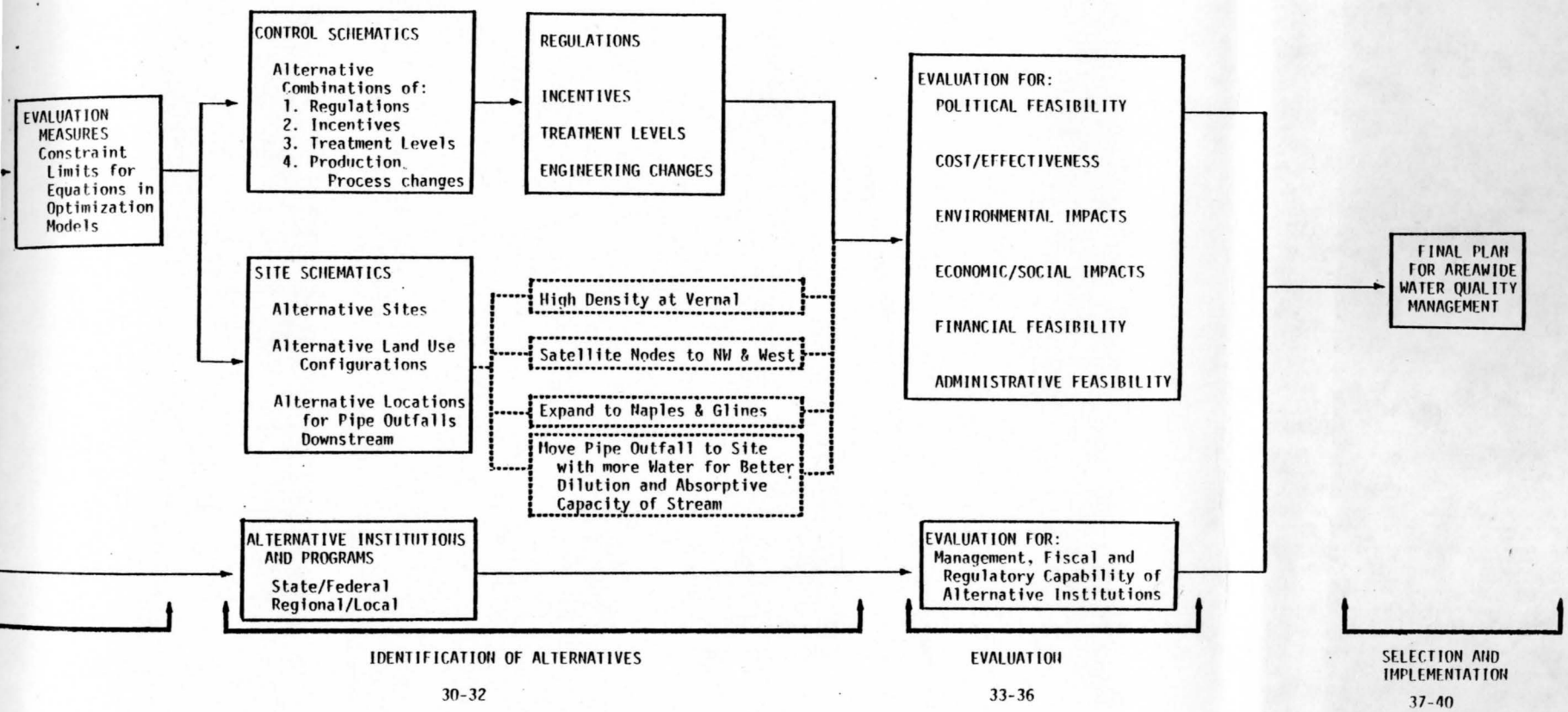
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2. Incentives
3. Treatment Levels
4. Production Process changes
REGULATIONS
INCENTIVES
TREATMENT LEVELS
ENGINEERING CHANGES
SITE SCHEMATICS
Alternative Sites
Alternative Land Use Configurations
Alternative Locations for Pipe Outfalls Downstream
High Density at Vernal
Satellite Nodes to NW & West
Expand to Naples & Glines
Move Pipe Outfall to Site with more Water for Better Dilution and Absorptive Capacity of Stream
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State/Federal
Regional/Local
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POLITICAL FEASIBILITY
COST/EFFECTIVENESS
ENVIRONMENTAL IMPACTS
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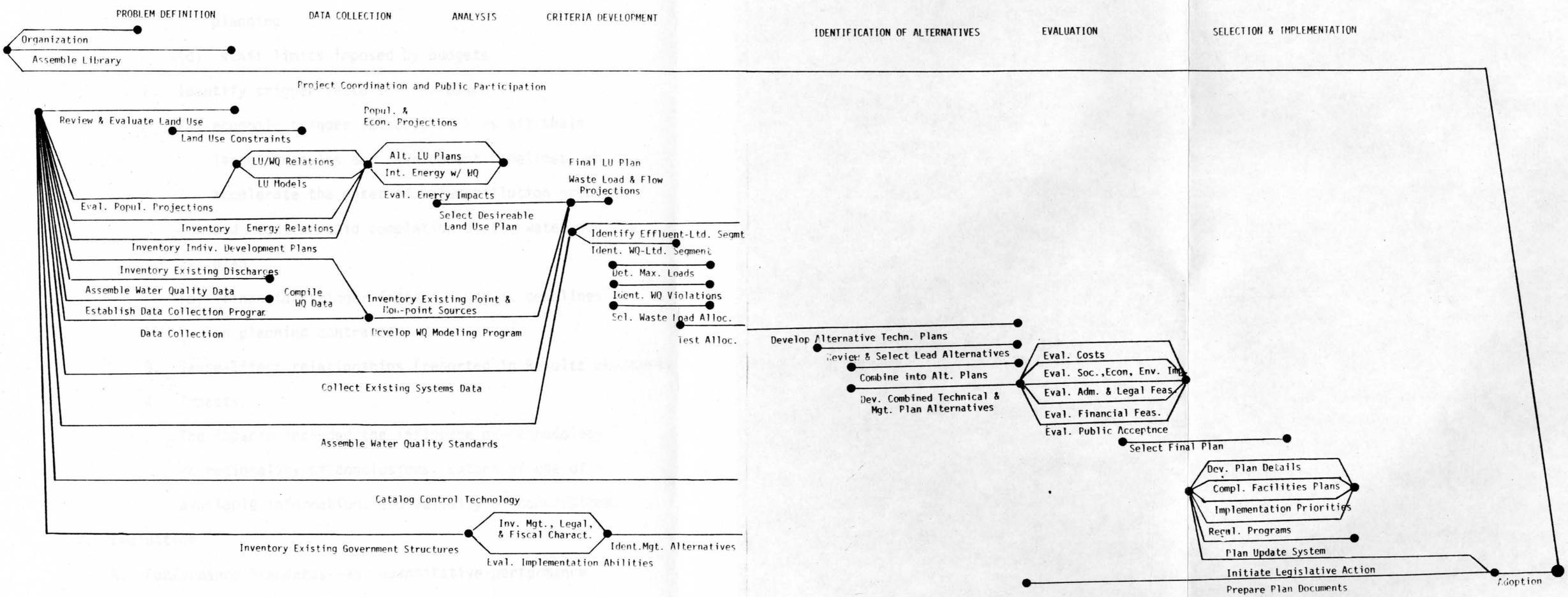
PROBLEM DEFINITION
DATA COLLECTION
ANALYSIS
CRITERIA DEVELOPMENT
IDENTIFICATION OF ALTERNATIVES
EVALUATION
SELECTION & IMPLEMENTATION
Organization
Assemble Library
Project Coordination and Public Participation
Review & Evaluate Land Use
Land Use Constraints
Popul. & Econ. Projections
LU/WQ Relations
LU Models
Alt. LU Plans
Int. Energy w/ WQ
Final LU Plan
Waste Load & Flow Projections
Eval. Energy Impacts
Select Desireable Land Use Plan
Eval. Popul. Projections
Inventory
Energy Relations
Inventory Indiv. Development Plans
Inventory Existing Discharges
Assemble Water Quality Data
Compile WQ Data
Establish Data Collection Prograr
Inventory Existing Point & Non-point Sources
Data Collection
Develop WQ Modeling Program
Identify Effluent-Ltd. Segmt
Ident. WQ-Ltd. Segment
Det. Max. Loads
Ident. WQ Violations
Sel. Waste Load Alloc.
Test Alloc.
Develop Alternative Techn. Plans
Review & Select Lead Alternatives
Combine into Alt. Plans
Dev. Combined Technical & Mgt. Plan Alternatives
Eval. Costs
Eval. Soc.,Econ, Env. Imp
Eval. Adm. & Legal Feas.
Eval. Financial Feas.
Eval. Public Acceptnce
Collect Existing Systems Data
Assemble Water Quality Standards
Select Final Plan
Dev. Plan Details
Compl. Facilities Plans
Implementation Priorities
Regul. Programs
Plan Update System
Initiate Legislative Action
Prepare Plan Documents
Adoption
Catalog Control Technology
Inv. Mgt., Legal, & Fiscal Charact.
Inventory Existing Government Structures
Ident.Mgt. Alternatives
Eval. Implementation Abilities

1. Identify limiting factors to planning methodology operation, such as:
   (a) financial limits of project budgets
   (b) time limits to more intensive analysis
   (c) political limits to implementation of land use planning
   (d) staff limits imposed by budgets
2. Identify trigger factors. For example:
   (a) economic trigger factors, such as oil shale lease schedules and development timelines, which accelerate the onset of water pollution problems and require rapid completion of the water quality plan
   (b) financial trigger factors, such as deadlines on planning contracts
3. Cause-Effect relationships (reported in Results chapter).
4. Impacts.
   The impacts included the influence of methodology on rationality of conclusions, extent of use of available information, and validity of conclusions.

V. Evaluation

A. Performance Standards--No quantitative performance could be found in the literature. Qualitative performance standards applied were the criteria consolidated and stated in the Evaluation Model in Chapter III.

VI. Conclusions

Findings were prepared to summarize the results of the evaluation. The conclusions included positive recommendations for improving the methodology and plan.

CHAPTER III

LITERATURE REVIEW OF EVALUATION CRITERIA

The basis for the evaluation was developed through reference to impartial professional sources. Several sources were investigated and their criteria assembled.

Chadwick[1] proposes the following criteria for evaluating a planning methodology:

1. The methodology must include a "demonstrated, open display of rational procedure."
2. Must "acknowledge real world systems and administrative procedures."
3. Should have "no schism between planning process and implementation process."
4. Should be "readily understandable as a decision tool."
5. Should be "flexible, so as to provide for implementation through a variety of methods and tools."
6. Must have a "commitment to implementation."
7. Must be both "incrementalist", (open to incremental decision-making process) and "comprehensive" (overview approach).
8. Should have step-by-step coordination and review.

Wickersham[2] proposes the following criteria for a planning methodology:

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[1]George Chadwick, A Systems View of Planning: Towards a Theory of the Urban and Regional Planning Process (New York: Dowden, Hutchinson & Ross, 1971).

[2]Kirk Wickersham, A Land Use Decision Methodology for Environmental Control (Washington, D.C., Government Printing Office, 1976).

1. Incorporates policy planning as core of decision process.
2. Weaves environmental information into entire decision making and planning process--not just incremental additions like environmental impact statements.
3. Recognizes root causes--not just tymptoms.
4. Includes public participation.
5. Systematic.
6. Minimizes jargon.
7. Uses flexible implementation tools.
8. Identifies limiting factors.

Hoggan, et al.,[1] in a study on the effectiveness of water resources planning groups, made the following recommendations:

1. Organizational structures should be set up after the analysis of function and process.
2. Precise definitions and precise use of terms are needed.
3. Process should be explicit.
4. Interaction between process stages should be stressed more than the sequence.
5. Planners should relate alternatives back to goals and objectives.

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1. Danile Hoggan, et al., A Study of the Effectiveness of Water Resource Study Groups (Logan, Utah: Utah Water Research Laboratory, 1972).

The U.S. Environmental Protection Agency[1] reviews a water quality management plan for completeness in the following five main categories:

1. Planning and Implementation Action Recommendations
2. Continuing Planning Process
3. Planning and Management Agency Interrelationships
4. Local/State Planning Relationships
5. Public Participation

Selected from the EPA Review Summary are the following questions:

1. Will the work done solve the problems?
2. Is the environmental assessment reasonable and adequate?
3. Was the local agency responsive to public concerns raised, and was public awareness of technical and political issues heightened?
4. Has the program resulted in an increase in the local government's ability to provide for problem solving in environmental, economic, and social problem areas, and/or long-term planning and management?
5. Has the continuing planning process been established, and is it reasonable and adequate for advanced problem solving?

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[1]U.S. Environmental Protection Agency, Memorandum on "In-House Review Process for Draft Interim Outputs and 208 Plans" Seattle: (mimeographed), p. 6.

6. Has the program increased the exposure of the local decision process?

EPA's proposed regulations[1] require that the water quality plan elements meet the following stipulations:

1. Be based on land use, demographic and economic data.
2. Evaluate alternative control strategies and select point and non-point source control programs.
3. Assess environmental, social and economic impacts of implementing plan provisions.
4. Analyze primary and secondary impacts.
5. Assess impacts on urban development and contain measures for mitigation of adverse impacts.
6. Assure consistency with other planning activities.
7. Be technically valid.
8. Be economically feasible.
9. Fulfill work plan commitments.

Evaluation questions assess whether each of these factors was conducted thoroughly.

Author's Criteria

The following list was developed by the author to isolate specific questions which should be asked in an evaluation:

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[1] U.S. Environmental Protection Agency, Proposed Water Quality Management Regulations, (U.S. Government Printing Office, September 1978), pp. 21, 27-29.

1. How is information used in the planning process?
   a. What information is collected?
   b. What format?
   c. What units of measure are needed to describe impacts? What units of measure are available?
2. How is the information analyzed?
   a. What procedures are used?
   b. Are the procedures appropriate for the data available? (e.g., the use of sophisticated procedures on data of poor quality is misleading).
   c. Are the recommendations consistent with the data results?
3. How is analyzed data used in other stages of the planning process?
   a. What other stages, activities, or tasks require the same input data, or need the output data of a prior stage?
4. What other planning programs in the region need related data or results?
   a. Do they need it for current planning studies?
   b. Might they want to update an existing plan?
   c. Should the results of analyses be announced immediately to influence imminent decisions?
      (1) Are the decision-makers within the advisory board of the planning team?

(2) Are the decision makers outside the region, such as in federal land agencies in Washington, D.C.?

5. What provisions have been made for public participation to ensure validation of assumptions, accuracy of data and projection, and political viability of the alternative plans?

Evaluation Model Used in This Study

An evaluation criteria assembled from the various sources discussed, including those of the author, is summarized. This consolidated set of criteria was used as an evaluation model to guide the case study evaluation. It could be used by other evaluators as a general guide in other studies.

Evaluation Model

EPA Criteria[1]

1. Was a management plan prepared to guide the planning methodology, and was it adequate?
2. Were the work plan commitments fulfilled?
3. Is the plan based on available land use, demographic and economic data?
4. Were adequate data collected on existing conditions and problem areas?
5. Were alternative service areas and sites evaluated?

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[1]From EPA Guidelines, Evaluation Guides, and In-House Memorandums.

6. Were most potential point and non-point sources of pollution identified?
7. Were alternative control strategies evaluated?
8. Are alternatives evaluated according to impact on land use and urban sprawl?
9. Was the area-wide plan developed in concert with basin and regional plans and facility plans?
10. Is the plan compatible with land use and transportation plans?
11. Does the plan assess secondary impacts and contain mitigation measures?
12. Are the operations technically valid?
13. Does the water quality plan contain a schedule of implementation actions?
14. Does the plan suggest an adequate implementation agency?

Professional Criteria

Chadwick[1]

1. Is the process open and rational?
2. Acknowledge administrative procedures?
3. Understandable decision tool?
4. Flexible? Use a variety of methods?
5. Committed to implementation?

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[1]Chadwick, A Systems View of Planning: Towards a Theory of the Urban and Regional Planning Process.

6. Both incremental and comprehensive?

7. Step-by-step coordination and review?

Wickersham[1]

1. Does the process have policy planning as core?

2. Environmental information throughout?

3. Root causes, not just symptoms?

4. Public participation?

5. Systematic?

6. Minimize jargon?

7. Flexible implementation tools?

8. Identify limiting factors?

Hoggan, et al.[2]

1. Was organizational structure set up after function and process?

2. Precise definitions and terms?

3. Process explicit?

4. Interaction of stages stressed more than sequence?

5. Alternatives tied to goals and objectives?

Author's Criteria

1. Are the procedures appropriate for the data available?

2. Is the output format logical and revealing?

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[1]Wickersham, A Land Use Decision Methodology for Environmental Control

[2]Hoggan, et al., A Study of the Effectiveness of Water Resource Study Groups

3. Are the recommendations consistent with the data results?
4. Is data used or just displayed?
5. Is information carried forward to other stages of the process?
6. Do other programs get the data in a timely manner?
7. Are existing plans used and updated for application?
8. Is collected information distributed to influence imminent decisions?
9. Are the decision makers receiving a range of options?
10. Are interest groups given the opportunity to question or validate assumptions, accuracy, and political viability of plans?

CHAPTER IV

ANALYSIS

Background Analysis

This chapter is divided into two parts, a background analysis and a methodology analysis. The background analysis is an examination of the context, site and program which influenced the design of the water quality planning methodology. The second part of the chapter is an analysis of the methodology itself.

Context

The Uinta Basin is an agricultural region in transition to an energy development economy. Oil shale development on federal and state lands leased to energy development corporations could lead to a doubling of population in Ashley Valley by 1995.[1] Rapid migration into the area of workers and their families could lead to boom town effects. If demands for facilities and services exceeds the local ability to provide them, there could be financial crises, environmental degradation, inefficient and costly utility patterns, and loss of rural lifestyle. Environmental degradation could occur if sewer lines, treatment plants and septic systems exceed capacity. Corresponding overflow into receiving streams and lakes could exceed the

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[1] Horrocks and Corollo Engineers, Technical and Institutional Alternative Management Practices for the Reduction of Point and Non-point Pollution Within the Uinta Basin Planning Area (Uinta Basin Association of Governments: Roosevelt, Utah 1976), p. iii.

capacity of the waterways to absorb pollutants. Treatment plants need to be upgraded to prevent pollution inputs. From a land use planning perspective, there are a number of regulatory and capital facility design options which could help to prevent water quality degradation. Development of a comprehensive urban plan, with accompanying land use element, could be one way. Implementation of the plan could be achieved by extending facility networks such as water and sewer in patterns which would raise land values and residential suitability of preferred districts. Regulatory techniques, such as zoning, protective easements along waterways, agricultural and development rights restrictions, industrial parks, zoning, site performance standards, and other tools can be applied.

In the Uinta Basin there is a conservative attitude toward government regulation which works against the use of innovative approaches to preventing land use and water quality problems. Several planners and other professionals from the region expressed during the study that the implementation of planning in the region would be very difficult. This was primarily due to one or another of the following:

1. Lack of past enforcement of the HUD 701 Comprehensive Plan.
2. Lack of coordination between cities and counties regarding land use controls.
3. Isolated actions on the parts of member governments without the support of others, sometimes leading to direct conflicts (e.g., annexations).

After a change in board membership, except for the Duchesne County Commissioner, all the recently enacted zoning ordinances were reversed, essentially eliminating all land use controls in that county.[1] Nevertheless, formal planning has occurred in Ashley Valley. Table 1 shows the history of planning efforts.

Selected Planning Goals and Policies for the Ashley Valley[2]

Residential Development

A. New development within the county should be orderly and economically beneficial.

B. Ordinances and policies to insure orderly and high-quality development should be adopted.

C. Improvement of the esthetic amenities of the county should be encouraged.

D. Taxation policies should be amended as required by the state.

Commercial Development

A. Commercial centers should be developed into increasingly more attractive, convenient, and serviceable trading and business centers.

B. New commercial districts should not be created unless actually needed.

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[1] Interview with Gerald Syme, planner for Uinta Basin Association of Governments, Roosevelt, Utah. May 24, 1976.

[2] Planning Goals and Policies for Uinta County and Vernal City, and Comprehensive Plan for the City of Vernal.

TABLE 1

GOVERNMENTAL AND CONSULTANT PLANNING IN THE ASHLEY VALLEY

Year	Plan	Federal Program	Consultant	Sponsor	Action
1969-70	Comprehensive Urban Plan	HUD 701	Urban Planning Consultant	City of Vernal Uinta County	Zoning regulations
1973-75	(No plan)	(No program)	(No consultant)	City of Vernal	Water hookup moratorium Subdivision moratorium Annexation of industrial land
1975-76	Wastewater Facilities Plan	EPA 201	Water & Sewer Engineers	City of Vernal	Utility extensions Service area expansion
1976	Preliminary Land Use Report	EPA 208	None (UBAG staff)	UBAG	Used in water quality planning
1976-77	Areawide Water Quality Management Plan	EPA 208	Water Quality Engineers	UBAG	None at time of study, as plan was just completed.

C. A central business district should be organized.

Industrial Development

A. The area should be made more inviting as a location for industry.

B. Mixing of incompatible land uses should be prevented.

C. The development of natural resources should be encouraged.

D. Efforts should be made to build up and diversify the industrial base.

Agricultural Development

A. The county's prime agricultural land should be kept in production until actually needed for other purposes. Nonfarm development of agricultural land should be discouraged.

B. Ordinances regulating development should be reviewed and revised where needed, and then enforced.

C. County soil survey should be completed.

D. Persons should pay for all county services rendered to them.

The Uinta Basin Association of Governments

The Uinta Basin Association of Governments is a voluntary council of governments which was created to obtain grant money, services, coordination, and planning assistance. The charter states that "problems of growth and development so transcend the boundary lines of our local government units that no single unit can plan

for their solution without affecting other units within the region." The charter also declares the purpose of the organization to be policy planning, developing action recommendations, and implementing planning and development programs.[1]

The detailed activities engaged in by UBAG include development and review of policies, coordination of local and regional grant applications, and provision of technical planning assistance to member governments.

Councils of government do not have legal authority to deliver public services, regulate their respective populations except by local rule, or to collect taxes. Therefore, enforcement of any regulations proposed by the COB must be adopted by the particular member councils and enforced by them. UBAG cannot, therefore, implement planning programs or plans directly. An example of the lack of coordination of plans is the limited utilization of the 1970 comprehensive plan. When the Ashley Valley 201 Wastewater Facilities Plan was prepared, the consultant attempted to base the utility pattern on the comprehensive plan. For whatever reason, the commissioners instructed that the proposed utility plan be amended. The amended plan did not follow the land use pattern proposed in the comprehensive plan.[2]

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[1] Uinta Basin Association of Governments, Charter (1973).

[2] Interview with Syme, May 24, 1976.

There could be several reasons for this apparent contradiction. Land use planning per se has been discouraged in the region in the past. The comprehensive plan was by that time four years old, and might not have been up to date with changing conditions. Recent lease schedule announcements may have changed the demands for rural land. The commissioners may have thought that recent actions by the City of Vernal were adequate land use controls. The City of Vernal was experimenting with a water hookup moratorium,[1] and was considering a moratorium on new construction activity in subdivisions. The city had eliminated strip zoning[2] and annexed a great deal of industrial land formerly under county taxing jurisdiction. Severe communication problems emerged between the city and the county, discouraging planning coordination.[3]

Program

As used here, a program is the set of activities which describes the magnitude and character of expected development. Table 2 shows projected population forecasted by UBAG and its consultants. The projected doubling of population could have significant implications for demand for facilities and housing and related land space. The spatial distribution of the population and facility demand is the major concern of subsequent land use analysis.

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[1]Interview with Kenneth Fisher, planner for the City of Vernal, Vernal, Utah. November 14, 1975.

[2]Public presentation by Glade Nelson, City Manager of Vernal. Second annual conference, Utah Chapter of the American Institute of Planners, Salt Lake City, Utah. May 9, 1975.

[3]Interview with Fisher, November 14, 1975.

TABLE 2

POPULATION PROJECTIONS BY UBAG AND CONSULTANTS

	1975	1980	1985	1990	1995
Vernal	6,405	7,700	9,600	10,900	12,200
Ashley Valley	7,252	8,900	11,000	12,400	13,800
Total	13,657	16,600	20,600	23,300	26,000

Source: Adapted from Horrocks and Corrollo, Uinta Basin Water Quality Plan (Roosevelt, Utah: Uintah Basin Association of Governments, 1977.)

UBAG considered the early projections of the state planning coordinator's office to be off target by as much as forty percent in some scenarios.[1] (The state planning coordinator's office had prepared forty scenarios and projected spatial distribution down to the census subdistrict level.) UBAG did not prepare many scenarios. This may prove inflexible, if a set of events other than those assumed actually materialize. An inaccurate program projection could lead to an overbuilt system, saddling taxpayers and local financiers with higher costs than necessary.

Under the assumptions in the final draft of the Water Quality Management Plan, no new town would be built. That is the best professional judgement of the collective minds at that one point in

[1] Interview with Syme, May 24, 1976.

time. But the uncertainty of making long-term projections makes the single scenario susceptible to changes in future conditions. If that scenario does occur, the majority of the population growth would occur in Vernal and the Ashley Valley. Wage income is expected to increase more than one hundred percent, and housing requirements would increase seventy five percent, an increase of 6,253 dwellings.[1] UBAG's population projections could be thrown off considerably if population centers emerge in other parts of the region. Several assumptions were made which may not necessarily be the only ones possible. Several variables outside the control of Ashley Valley residents could alter the outcomes, such as lease schedules, development financing, market conditions, and construction of new communities.

A new town may be built about forty miles southeast of Vernal, near the border of Colorado and Utah. The oil shale companies have been considering building a new town to reduce the wages and other costs associated with the higher commuting distance from Vernal and possible locations in Colorado. The most likely site would be on the White River itself. A dam may be built to supply water and/or electricity. Permanent housing might be required for up to 2,500 people. Similar communities, not necessarily "company towns," have been built recently in other resource development sites, such as Colstrip, Montana, so precedents have been set which demonstrate economic viability of new towns.

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[1] Horrocks and Corollo, Engineers, Uinta Basin Areawide Water Quality Management Plan (Roosevelt, Utah: Uinta Basin Association of Governments, 1977), pp VII-18-24.

Most of the decisions for a new town are unsettled and depend on the eventual price of shale oils, extent of government participation in financing, and recommendations from the Governor's Planning Council on Oil Development.[1] Substantial costs would be incurred by the public, so government participation is not at all guaranteed.

Site

Ashley Valley tilts to the southeast at a grade of one to two percent, from Ashphalt Ridge toward Ashley Creek. Asphalt Ridge forms the visual and physical boundary to the valley, but also provides a drainage pattern that is significant to land use patterns and water quality. The outwashed gravel and alluvial topsoil overlie a layer of Mancos shale and clays, which create an impermeable hardpan. The hardpan prevents downward percolation and infiltration of draining water, so the water is redirected laterally down the slope. As the water reaches the gentler slope of the valley flow, the soils are filled with additional water. This phenomenon is most pronounced in the spring and summer, when highline canals carrying irrigation waters saturate the hillside soil layer. The goundwater in the poorly drained valley soils is also at seasonal capacity, and the addition of hillside water creates groundwater flooding. Impacts on land use are flooded septic tanks and consequent health and

[1]Merrill Littlewood, Public presentation, White River Shale Development Company, Vernal, Utah. January 26, 1975.

sanitation hazards, flooded basements, and sewage effluent flowing on the surface where it can come into human contact. Figure 4 is a map of the Ashley Valley area.

Additional effects of the landscape on land use patterns are caused by the eastern plateau. The Mancos shale provides poor growing conditions for field crops, so the range is little used. The front of the plateau is a steep escarpment, creating a natural barrier to access for urbanization.

Soils of the Ashley Valley are generally suitable for structures. Both the alluvium and the gravel terraces can support development. The terraces are better suited to structures than agriculture because of their inability to retain water applied through irrigation. The same gravels provide a more soild base for structures. The main soils, clays and shales are not suitable for development. These have a high potential for shrink and swell. Alluvial soils along rivers must be avoided due to flood plain hazards. Use of benches requires engineering care to avoid loading the edge of the hill, cutting the toe, adding water loads, or imposing heavy vibrations.[1]

Industrial growth is extending southeast along Highway 40 from the zone suggested for industrial growth in the 1970 comprehensive plan. The roadside businesses along much of this area consist of pipe storage yards and other industrial uses requiring large land parcels. Most of the businesses service the oil development industry.

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[1]Interview with Andrew Godfrey, Geologist, Vernal, Utah, November 12, 1975.

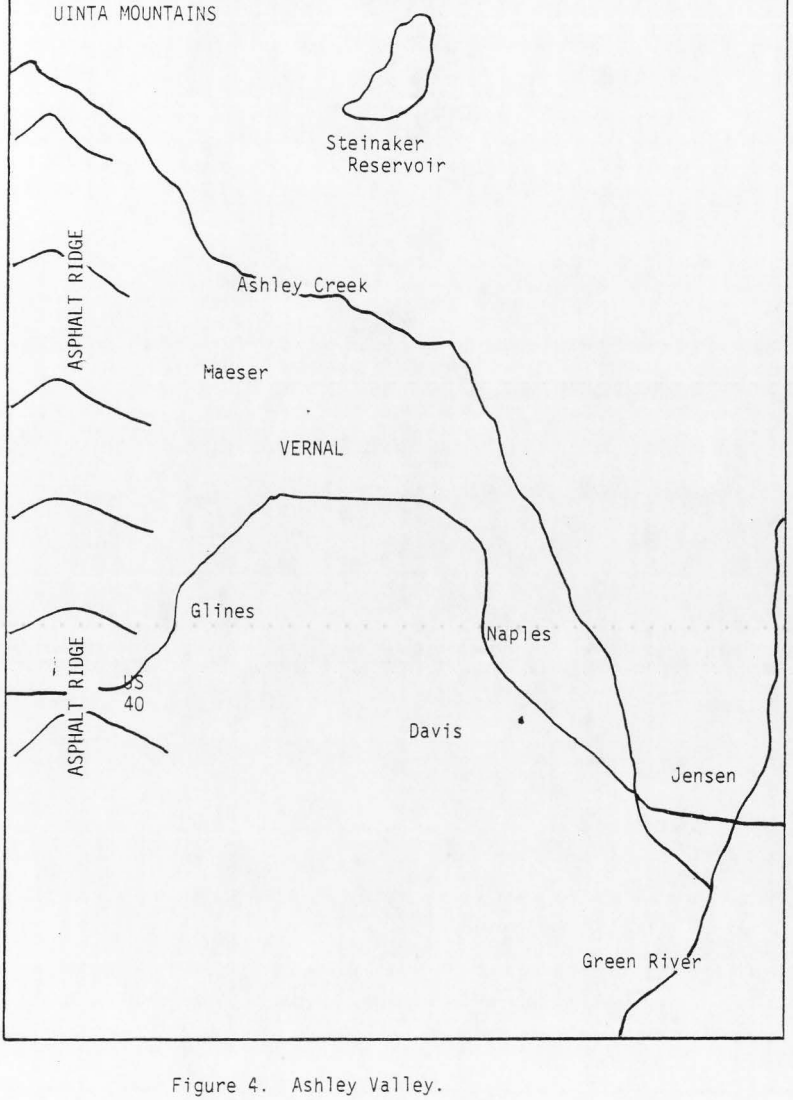

Figure 4. Ashley Valley.

Some residential growth apparently started near Naples and Davis in the last few years, but has not been substantial. The reason for this may be due to the recent annexations, moratoria, and regulations instituted by the city and county.

The lack of clear policies for confining growth patterns to any specific locations makes it difficult to predict where future land use will evolve. If it can be assumed that growth will follow a natural urbanization pattern (based on a combination of cost minimization and access maximation), then land capability and municipal utilities can be used as indicators. However, the recent growth of Vernal and Maeser has been only along the utility and road pattern, in disregard of land capability patterns. Access maximization appears to have been the primary locational criteria in site selection by individual homeowners and businesses. The poorly drained soils of the Maeser district were overlaid with a typical grid utility pattern and road network, requiring people to locate in swampy areas where the subdivided lots were available. The county did not take into consideration the construction limitations inherent on such lands or the long-term water quality problems which could be created from building on such soils (Figure 5).

The short-term costs savings the county achieved by putting in grids was discounted by the high costs incurred by private landowners. High costs have been incurred due to building on poor soils, importing fill material for foundations, pumping water out of basements, and facing health hazards. The county is now paying higher costs to

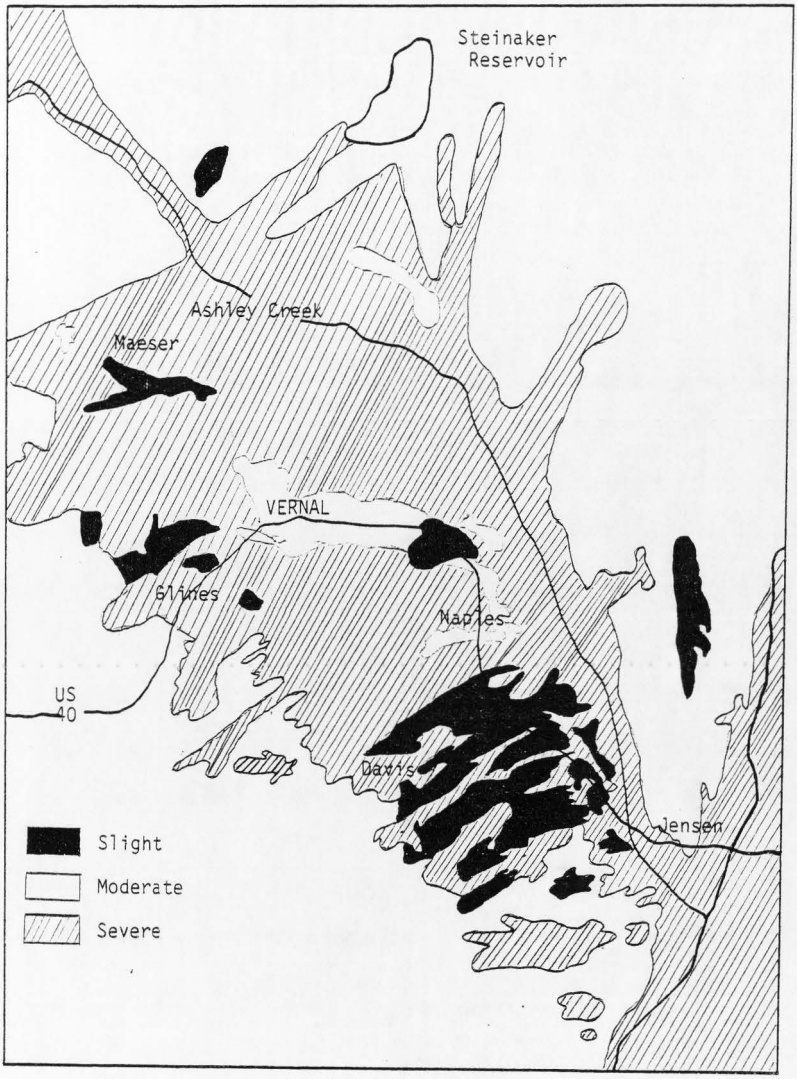

Figure 5. Soil limitations to small building foundations in Ashley Valley. (Source: Uintah County-Vernal City Planning Commission, Comprehensive Plan for Vernal City, Utah (Vernal, Utah), July 1970.)

install a water and sewer system to alleviate the public health problem. State and federal grant money required to install the system means that state and federal governments are also bearing the costs that could have been avoided by more careful land use planning and facility planning several years ago.

In other parts of Ashley Valley similar examples exist. Lots now are being provided in subdivisions on Asphalt Ridge, which overlooks Ashley Valley and the Green River. Extending water and sewer lines to that area will be more expensive for the county than would be a compact pattern around Vernal. It may be that the higher income to the county due to higher assessed value of those lots (and higher taxes derived from them) offsets the service costs. However, in many counties of the West, the total public service costs have been found to be higher than the income derived.

Whether or not the public and private sectors take land capability into consideration in future expansion plans has yet to be seen. There are signs that the city and county governments are beginning to recognize some of the potential costs of random service patterns. However, land capability has yet to be used as a major determinant of urban form.

Maeser is an example in which both the public and private sectors have paid dearly for ignoring land capability of the site. Similar problems could be avoided by encouraging development toward Naples and Davis, where there are good soils for building foundations,

and where drainage is relatively moderate. The lands are presently in agricultural use, but the soils are classified as only moderate quality for agriculture.

The water pollution potential is high because the feedlots are a diffuse source of fecal coliform. Residential development in Naples and Davis would provide housing closer to the oil shale fields than Maeser and still be within the distance reasonable for extending services from Vernal. Another area of higher capability than Maeser is just north of Maeser. That area has better soils and is adjacent to the highway leading to Roosevelt.

In 1976, the main water quality problem was groundwater contamination. Percolation from the highline irrigation canals down Asphalt Ridge over the Mancos shale hardpan was brought to the surface in the valley, flooding out septic tanks. The anticipated sewer and water system should alleviate that problem. However, the high groundwater table has created extra design problems and costs in order to avoid infiltration and inflow to pipes.[1]

The main surface water problem is the high levels of total dissolved solids (TDS) from irrigation return flows, which carry away salts and fertilizer residues. Likewise, urban runoff is expected to be a significant contributor to TDS.[2]

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[1] Interview with Russ Vernon, Uinta Engineering and Surveying, Vernal, Utah. May 24, 1975.

[2] Horrocks and Corrolo, Uinta Basin Areawide Water Quality Management Plan, pp. II-22-25.

Ashley Creek is virtually empty below Vernal due to diversions to Steinaker Reservoir for urban and agricultural use. This has the effect of concentrating the TDS even more in the remaining water return from irrigation and municipal treatment plant discharges. Both groundwater and surface water may be adversely affected by leaching from solid waste disposal sites located in natural drainages. Some mineral deposits in the Uinta Mountains dissolve in groundwater, and are carried in solution to rise elsewhere as mineralized surface water or well water.[1]

Water quality planning was conducted to solve these and other problems. The examples mentioned above demonstrate the close relationships of land use and water quality planning. Integrating the two through methodology design is examined in the next section.

Methodology Analysis

The purpose of this section is to analyze the structure and function of UBAG's methodology. First, a quick literature review is provided to identify a theoretically correct planning methodology. Second, the model methodology is used to explain the ideal sequence of water quality planning activities. Third, UBAG's particular methodology is described. Fourth, UBAG's methodology is analyzed. Analysis is performed by displaying the sequence of UBAG's planning activities in flow charts and identifying missing elements.

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[1] Uinta Engineering and Surveying, Draft Wastewater Facilities Plan, Vernal, Utah, April 1975. (Mimeographed).

Literature review of planning methodology. A summary of the planning methodologies used in studies by several different disciplines follows.

Planning Methodology Models

Schein,[1] Organization Development

1. Problem formulation
2. Generating Proposals
3. Forecasting consequences
4. Action planning
5. Action steps
6. Evaluation of Outcomes

Brock,[2] Public Administration

1. Identify problem
2. Define terms
3. Establish standards
4. Analyze
5. Examine possible solutions
6. Select solutions
7. Implement

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[1]Edgar Schein, Process Consultation (New York: Addison-Wesley 1968), p. 47.

[2]Bernard L. Brock et al., Public Policy Decisionmaking Systems and Comparative Advantages Debate (New York: Harper & Row, 1972), p. 7.

Hufschmidt and Elfers,[1] Water Engineering

1. Specify objectives
2. Develop planning guides and criteria
3. Formulate and evaluate plans
4. Review consequences of plans

McLoughlin,[2] Urban Planning

1. Scanning the environment
2. Formulation of goals
3. Possible courses of action
4. Evaluation
5. Action

Esogbue,[3] Systems Engineering

1. Problem formulation
2. Statement of objectives
3. Specification of objectives
4. Consideration of resources and constraints
5. Generation of alternatives
6. Evaluation methodology
7. Recommendations

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[1]Maynard Hufschmidt and Karl Elfers, Water Resources Planning in the Urban-Metropolitan Context (Chapel Hill, N.C.: Center for Urban and Regional Planning, University of North Carolina, 1971), p. 31

[2]J. Brian McLoughlin, Urban and Regional Planning: A Systems Approach (New York: Praeger Press, 1969) p. 102.

[3]Augustine O. Esogbue, Integrative Procedures for Coordinated Urban Land and Water Management: A Systems Analysis (Atlanta, Ga. Institute of Technology, 1975) p. 19.

Toth,[1] Landscape Architecture

1. Problem formulation
2. Data inventory
3. Analysis
4. Criteria development
5. Concept development
6. Evaluation and selection
7. Implementation

Kaiser and Reichert,[2] Environmental Planning

1. Problem identification and analysis
2. Goals, objectives and choice criteria
3. formulation of alternatives
4. Evaluation of alternatives
5. Action decisions
6. Feedback

There seems to be general agreement among the various authors as to the fundamental steps and sequence for a planning methodology. A model which includes the essential steps would be the following:

1. Problem definition
2. Data collection
3. Analysis

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[1]Richard E. Toth, "An Approach to Principles of Land Planning and Design" (Cambridge, 1972) (mimeographed)

[2]Edward J. Kaiser and Peggy Reichert, "Land Use Guidance System Planning for Environmental Quality" Natural Resources Journal, 15 (July 1975) p. 530.

4. Criteria development
5. Identification of alternatives
6. Evaluation of alternatives
7. Selection and implementation

While this is an idealized methodology and stages may overlap, it follows the scientific method and is rational and logical. It is systematic and encourages impact analysis, followup and monitoring. If a new methodology follows this general sequence, it has a better probability of also being rational and logical. Conformance with this model should, therefore, be one test in an evaluation of a planning methodology.

The normative water quality planning methodology. Guidlines produced by the U.S. Environmental Protection Agency for water quality planning generally encourage conformance to the model described in the last section. The following is an overview of the ideal water quality planning methodology, following the model sequence.

Problem definition: Water quality problems need to be defined according to location, type and magnitude. Known and potential sources should be listed. At this pre-analysis stage, land uses contributing to water pollution should be identified and related factors examined.

Data collection: Projections need to be made for economic development, population growth, related facility demand, and land requirements. This will allow better understanding of potential land

use changes to be expected, and the potential for conversion of land from rural to urban uses. Specific sites for industrial development sites should also be identified. Samples of water should also be taken.

Analysis: Water quality engineering consultants should input the land use information and water quality data to computer models of groundwater, streams, and lakes to predict the extent of future pollution. Since water flow may move pollution downstream, transport studies and simulation models should be prepared to replicate the transformations under different pollution loading levels.

Identification of alternatives: Alternative management strategies should be identified. These should include a combination of structural, engineering and regulatory techniques.

Evaluation of alternatives: Evaluation of each management strategy based on criteria formulated earlier, such as cost-effectiveness, conformance with standards, political and administrative feasibility, local implementation capability, consistency with other plans, and public acceptance.

Products expected from the planning are the following:

1. Narrative descriptions of land use and water quality problems to be alleviated.
2. Projections of population and economy over each five-year period.

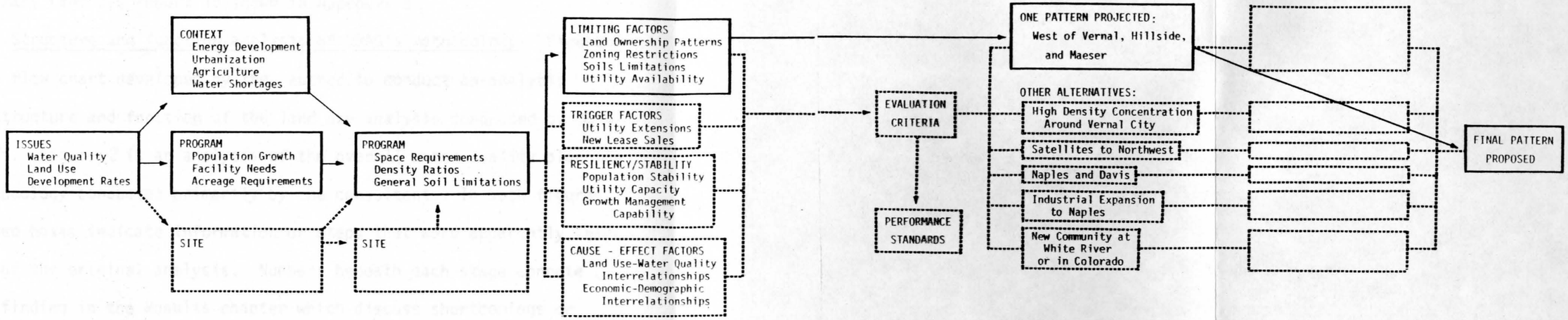
3. Maps of waste loads for point and non-point sources
4. Recommended strategies for controlling waste loads to meet the established water quality objectives.

Description of UBAG's methodology. UBAG's consultant prepared a workplan summary which proposed the following tasks:

1. Study initiation and project management.
2. Collect planning data
3. Identify reservoir, stream and groundwater segments
4. Coordinate resource development plans,
5. Suggest alternative management plans
6. Arrange management planning
7. Develop combined technical and management plan alternatives
8. Evaluate alternatives
9. Select final plan
10. Develop detailed description of plan features
11. Initiate legislative action, if required
12. Publish plan and standards

The entire workplan summary is in Appendix A. The sequence and relationship of tasks and subtasks is displayed in the critical path chart shown in Figure 6.

Within the stage called "Planning Data Collection" was an element in which "land use constraints" were to be outlined and base maps prepared. The output was to be preliminary conclusions on the relationships between land use and water quality. That stage also


CONTEXT
Energy Development
Urbanization
Agriculture
Water Shortages
ISSUES
Water Quality
Land Use
Development Rates
PROGRAM
Population Growth
Facility Needs
Acreage Requirements
SITE
PROGRAM
Space Requirements
Density Ratios
General Soil Limitations
SITE
LIMITING FACTORS
Land Ownership Patterns
Zoning Restrictions
Soils Limitations
Utility Availability
TRIGGER FACTORS
Utility Extensions
New Lease Sales
RESILIENCY/STABILITY
Population Stability
Utility Capacity
Growth Management Capability
CAUSE - EFFECT FACTORS
Land Use-Water Quality Interrelationships
Economic-Demographic Interrelationships
EVALUATION CRITERIA
PERFORMANCE STANDARDS
ONE PATTERN PROJECTED:
West of Vernal, Hillside, and Maeser
OTHER ALTERNATIVES:
High Density Concentration Around Vernal City
Satellites to Northwest
Naples and Davis
Industrial Expansion to Naples
New Community at White River or in Colorado
FINAL PATTERN PROPOSED
PRE-ANALYSIS / PROBLEM FORMULATION STAGE
DATA INVENTORY STAGE
16
ANALYSIS STAGE
14,15,17
CRITERIA DEVELOPMENT
18, 19
IDENTIFICATION OF ALTERNATIVES
8, 10a-d, 11
EVALUATION OF THE ALTERNATIVES
19, 20
SELECTION AND IMPLEMENTATION
9,21,22,12

included preparation of alternative land use plans. The plans would then be used to predict potential sources of pollution. The product of that tasks was to be the Preliminary Land Use Report. The Preliminary Land Use Report is shown in Appendix B.

Structure and function analysis of UBAG's methodology. Figure 6 is a flow chart developed by the author to conduct an analysis of structure and function of the land use analysis conducted by UBAG staff. Figure 2 is an analysis of the overall water quality planning methodology conducted primarily by the consultant. In both figures, dashed boxes indicate information or steps that were apparently left out of the original analysis. Numbers beneath each stage connote the finding in the Results chapter which discuss shortcomings or positive findings more thoroughly. Dashed lines between boxes indicate information flows which should have been established to coordinate information exchange.

Several functions are implied in the diagrams, but are not explicitly illustrated. For example, there should be review of a planning product after each box in the diagrams. The project manager should review each product for quality control. This management activity provides the monitoring feedback function which would be connoted by dotted lines feeding back to each prior box. Also implied in the diagrams are diamond symbols which normally connote a decision point. Decision points should be assumed to exist at the completion of every stage or box. Feedback loop lines and

decision point diamonds have not been included because additional symbols would make the figure more difficult to read. The project manager should make a conscious decision when reviewing the products of each task, whether or not to continue the flow of information or go back and revise earlier estimates on the basis of new information.

Flow charts in Figures 2 and 3 are interpretations of the planning methodology based on the critical path chart, intermediate reports describing planning activities, interviews with planners in the region, and the workplan.

The author's analysis was made more difficult by the fact that the consultants described their methodology in terms of task sequences rather than information flows. The flow charts prepared by the author depict information flows and relationships, in addition to tasks. Conclusions derived from the structure and function analysis are reported in the next chapter.

CHAPTER V

RESULTS AND DISCUSSION

This chapter reports the results of the evaluation. The first part is a summary listing of all the findings. The second part is a detailed explanation of each finding.

The findings are based on the analysis discussed in the last chapter, and displayed in Figures 2 and 3. The sequence of the findings follows the sequence of the planning stages in the planning methodology. For example, findings pertaining to problem formulation are presented early, while findings pertaining to implementation are presented later in the chapter.

At the end of the discussion of each finding is a code by which the interested reader can refer back to the original set of evaluation criteria to determine the author's reason for evaluating that subject (see Chapter III). The symbol "E-1" refers to the first factor on EPA's list of evaluation criteria, "CH3" refers to Chadwick's third criterion, etc.

Some of the findings are positive, some neutral, and some negative. It is important to remember that the purpose of the research is to review the context, inputs and product to detect defects in procedural design from a land use planning perspective. The findings and recommendations are meant as constructive criticism for an otherwise well done project. UBAG and the consultant might have conducted

the suggested procedures and gathered the suggested information had they not been under constraints of limited time, staff, and budget.

Summary of Findings

Problem Formulation

Project management

1. Work plan sequence followed the stages of the rational problem solving model.
2. Project management focused on task-sequencing rather than interaction of the information relationships required for analytical synthesis.
3. Technical planning tasks were not separated from management planning tasks.
4. Work plan did not differentiate between levels of detail.
5. Work plan was vague.
6. Vagueness resulted in a black box effect.
7. The land use analysis should have been better integrated with the water quality analysis.

Land use analysis

8. Only one land use pattern was formulated, rather than several alternatives.
9. There was no concurrent governmental action to encourage any one pattern.

10(a-d). Examples of other land use patterns which were not discussed.

11. Alternative industrial sites were not identified.

12. Limiting of land use patterns limited the number of point and non-point source locations (though most were probably identified).

13. Limiting the number of land use patterns could have affected the results of the subsequent water quality modeling.

14. The land use modeling system contemplated in the work plan was not discussed in subsequent reports.

15. Only one scenario of future events was used, despite availability of preformulated sets.

16. Amount of land use data utilized was unnecessarily limited.

17. Acreage estimates were arbitrary, with no reference citations for "standard factors."

18. No criteria were provided for defining "developable" or "subdivision-prone" land.

19. Locational criteria display charts would have helped clarity of presentation.

20. Internal contradictions were evident in assumptions about regulatory policies.

21. A range of options was not presented to decision makers or modelers.

22. Management recommendtions for different magnitudes of development were not submitted to decision makers or modelers.

Data Inventory Stage

23. Economic data were combined from several sources, showing breadth.

24. Extensive water quality data were collected at a primary level.

Analysis

25. Function and structure of the water system were analyzed by simulation modeling--appropriate systematic procedures for the data available (although difficult for lay public to understand without intensive reading).

26. Limiting factors identified were political, physical, financial, biological, chemical and legal.

27. Analysis of "irreversible" conditions was also conducted through the simulation model (creating the same concerns as in No. 25).

28. Performance standards were the state water quality standards--a valid procedure, recognizing legal factors and tying alternatives to goals and objectives in a commitment to implementation.

Criteria Development

29. Criteria used for evaluation included all those suggested by EPA.

Concept Development (Identification of Alternative Plans)

30. The plan was developed in conjunction with the Ashley Valley Wastewater Facilities Plan.
31. Separate alternative plans per se were not developed; instead, plan elements were interchanged to formulate a single plan.
32. Manipulation of land use patterns was not seriously considered as a management strategy.

Concept Evaluation

33. Public participation and cost-effectiveness analysis were seriously conducted in accordance with EPA guidelines.
34. The impact evaluations for technical and institutional alternatives were extensive, but many of them were brief.
35. Evaluation of benefits, costs, and distributional effects for the overall plan were not conducted.
36. Secondary effects were not evaluated in depth.

Implementation

37. Implementation tools suggested were varied and flexible.
38. Plan elements are politically acceptable, fostering implementation.
39. An implementation schedule is provided in accordance with EPA guidelines.

40. UBAG has no legal power to force implementation.

The following text is a more detailed discussion of the findings summarized above.

Discussion of Findings

Problem Formulation

Project management.

Finding 1: The work plan sequence followed the stages of the model methodology. This made understanding of the methodology relatively easy, especially once the major stages were identified by the reader. The designer of the work plan and critical path chart could have made it easier for the reader by clearly displaying the names of the major stages of the model methodology. (E-1/Ch1)

Finding 2: Project management was focused on task sequencing rather than on the interrelationships of information. Project guidelines could have been improved with the addition of diagrams which showed flows of information and when in the methodology certain information would be collected. Such diagrams help to elucidate the basis for analysis and help both staff and public to understand the interaction of the land and water under study. Information flow charts also help to identify data collection needs. They can also be useful for helping analysts from different disciplines to see the format and scale of information needs later in the process, by other analysts. (E-1/H4)

Finding 3: Technical planning tasks were not separated from management planning tasks. The presence of both types of planning tasks in one work plan made it more confusing to read, and did not distinguish the burden of responsibilities between various analysts. EPA guidelines suggested separation of the task descriptions to alleviate this kind of problem. The diagram prepared by this author in Figure 6 demonstrates the usefulness of distinguishing technical and management planning. They are two separate subsystems operated by different types of specialists. (E-1)

Finding 4: The work plan did not differentiate between levels of detail. There was no differentiation between major stage, task, or the steps required to complete a task, so the analysts and public could not interpret the relative magnitude of tasks, or those which should be components of another, larger task. If other analysts had been able to better understand the interrelationships of tasks, then the relative importance and time requirements would have been more easily determined, and interdisciplinary interaction fostered. (E-1)

Finding 5: The work plan was vague. While the format looks well organized, many task, purpose, and scope statements are fuzzy and non-directive. An example is the following work plan element in Task 2 (see Appendix A):

Task 2. Planning Data

f. Review and evaluate current land use.

Purpose: To establish

(1) A background of past and present comprehensive planning as completed by the three counties.

(2) Regional Land Management Plan Framework

a. Inventory land use information to date

1. Develop base maps

2. Review pertinent planning programs

b. After six months, preliminary conclusions on the relationship between land use and water quality.

c. Look at all users of land in the UBAG area

1. Local, state and federal

2. Study land ownership maps

d. Correlate this information with:

1. Water quality information

2. Air quality/open space

3. Transportation

(3) Complete a Regional Goals and Objectives program.

The steps listed do not lead to the objectives stated, and no guidance is provided as to procedures to be used, such as land capability analysis. The author of the work plan seems to be trying to provide a view of the issues to be covered, rather than clarifying for project management purposes the analytical tasks and information in each element.

Finding 6: Vagueness resulted in a "black box" effect. Developing base maps and reviewing planning programs does not, alone, lead one to preliminary conclusions on the relationship of land use and water quality. No definition is provided as to how those relationships might be expressed. One can have numerous base maps, but no direct explanation of the land use water quality relationships. The phrase "Look at all users of land in the UBAG area" does not say anything. Staff planners, the public, and administrators are not told by what procedure the conclusions will or should be arrived at, making these steps essentially a "black box." (E-1/Ch1/C2)

Finding 7: Project management should have been more directive, to better integrate the land use analysis with the water quality analysis. The project manager could have improved the information collection and ordering by more directly supervising and directing the land use analysis. (The need for such management is discussed in the next section.) The manager could have specified closely what information would be required in the subsequent analyses, and taken a larger role in structuring the analysis so that the number of land use pattern alternatives, scenarios, and management strategy options would be forged.

Frequent reviews and staff meetings are needed to maintain a strong central coordination on such a project. Some individual has to be the "brain" behind the operation of the planning system.

The feedback and monitoring lines in the diagram in Figure 7 connote the need for periodic review of products, including designing the products early in the planning study. The first box on project management represents early intensive meetings to standardize staff understanding about the structure of the planning study and respective information needs. If, as the planning progresses, products are not produced on time, or the assumptions and content are not what early expectations indicated, the project manager should make appropriate adjustments. If that person does not do so, it is the responsibility of the planning director of the sponsoring agency to monitor and coordinate. (E-1, 3, 10, 12/H4/C5, 8)

Land Use Analysis Method

Finding 8: Only one land use alternative was formulated, rather than several, so that the number of service areas considered was limited. The single land use pattern composed of three emerging development districts was only one possibility, when, in fact, there could have been others (e.g., Findings 10-a-d). (E5)

Finding 9: While one could identify a "most probable" or a "desirable" land use pattern, there is no assurance that that pattern will emerge. UBAG's staff planner had assumed an unregulated growth pattern, which one could expect from the present commission's political stance on land use planning. But that policy may not continue over the course of the 20-year projection period. If the

population increases as expected, the political makeup of the commission could change, or a whole new commission could be voted into office. The recent trend in the valley of very stringent growth controls, such as subdivision and water hookup moratoria, are an indication that the regulatory policies are already changing. Therefore, alternative land use patterns should be identified, based on alternative growth policies and scenarios. (E5)

Finding 10a: One reasonable land use alternative might have been a residential development pattern around Glines and Davis, on the high-capability lands south of Vernal. These areas have good soils, slopes and proximity. They are marginal lands for agriculture and have high suitability for foundations. To ameliorate concerns about urban sprawl, the area could be kept a compact unit, under a satellite concept. (E5)

Finding 10b: An additional land use alternative might have been a new industrial park on the good soils just out of Vernal toward Naples. This would decrease congestion and incompatability of industrial uses with adjacent uses. Space requirements for industrial support yards, pipe storage yards, car sales lots, etc., could be provided a little farther from the intensively used streets near the commercial sector, yet proximity to support businesses would still be provided. Advantages for water quality purposes would be the proximity to the sewage treatment plant which might make more feasible a small area/high volume pipe system for collecting the urban runoff mentioned as a problem in the plan. (E5)

Finding 10c: Another land use pattern which should have been considered in the land use analysis is a concentration of residential development on the good building soils on the north and west sides of Ashley Valley. The regolith of Asphalt Ridge and the Uinta Mountains provides some foundation support capability, as well as elevation above the seasonally water-loaded, fine-grained soils of the valley bottomlands. Such an option would allow use of septic tanks, eliminating some of the need for extending an expensive collection system, and would preserve the grazing lands along the valley floor. Homes with scenic views might be possible, enhancing the land prices. The major drawback would be some sprawl, unless it was controlled through a planned unit development with a compact pattern. (E5)

Finding 10d: An alternative site for a treatment plant could have been along Ashley Creek, between Vernal and Naples. The site provides adequate land space, suitable soils, proximity to stream for discharges, flat topography at the lower end of the sloping valley to allow gravity feed system to a good building site, good dispersion of odors, and is equidistant between areas suitable for development. (E5)

Finding 11: Alternative industrial sites were not identified. Large industrial land uses often have extensive yard areas that may contribute significantly to non-point pollution through runoff. The industrial site identified was based on access and soils, but other

constraints exist, such as land ownership, utility availability, utility capacity for high-volume industrial wastewater discharges, and regulatory restrictions. There were no alternatives identified to prepare for the possibility that this one faced too many constraints. (E5)

Finding 12: Though most point and non-point sources were identified, the limiting of land use patterns limited the opportunity for consideration of additional potential sources. For example, each of the alternative land use patterns and sites listed by this author in Findings 10a-d would be additional locations of pollution sources. None of those were assessed because they were not identified in the original land use analysis. (E6)

Finding 13: Limiting the number of land use patterns could have affected the results of the subsequent water quality modeling. The stream is divided into "reaches" down its length, and pollutant loading estimates are obtained for each of these sections on the basis of expected land uses for land draining into each reach. If an industrial site or feedlot or a processing plant may more likely be located in a portion of the watershed draining into another reach, the pollutant loading calculations should be shifted to that other reach. Too much loading in a given reach may mean exceeding the stream's ability to oxidize pollutants expected for that area. Therefore, inaccurate land use forecasting can lead to inaccurate water pollution forecasting.

Finding 14: The land use modeling system contemplated in the work plan was not discussed in subsequent reports received. Most of the work plan commitments were fulfilled, but the absence of this work plan commitment reduced the potential quality of the subsequent analysis.

For instance, the state planning coordinator's office had a model prepared by consultants which used economic activity and population growth rates to identify future levels of development, and a submodel to determine physical facilities needed, locational requirements for sites, and number of acres needed. The model was capable of "allocating" (forecasting) those acreages down to the subdistrict level.

It would have been possible for UBAG to overcome any objections to the SPCO's quantitative assumption by inserting its own numbers into the model. That would have provided spatial distribution of land uses through a modeling system. After that, land uses could have been forecast at the more site-specific scale on the basis of more detailed information on land capability, suitability, proximity to infrastructure, capacity of infrastructure, etc. All UBAG or the consultant had to do to eliminate this critique point would have been to discuss these opportunities, in accordance with their work plan. (E2)

Finding 15: Only one scenario of future events was used, despite the availability of preformulated sets. This may have

affected conclusions about land use patterns. The state planning coordinator's office distributed a set of 24 scenarios for the region. Scenarios of alternative futures are a device to accommodate for uncertainty about the future. The use of scenarios is a rapidly growing professional practice for formalizing and documenting the review of potential future events, and validating the planners' assumptions. Where possible, contingency plans are prepared for as many of the alternative futures as possible. In many cases, policy sets are formulated where there is not time or money for more detailed plans for each scenario.

Since the SPCO had already provided UBAG with several preformulated sets, it seems reasonable to expect them to have been used. As an example, the land use analysis could have been structured to identify alternative land use patterns and acreage estimates for land demand according to the pressure created by different scenarios. This would have provided a framework for testing different locations of water quality impacts with different runs of the model. (E3)

Finding 16: The amount of land use data utilized was unnecessarily limited. The effects of land use on water quality are so significant that more attention should have been paid to collection of primary data. Some data were collected by UBAG staff on the number of mobile homes and the number of sewer hookups, and the USDA Soil Conservation Service was consulted for assistance in aerial photo interpretation. However, other data in existence already, such as the soils suitability

maps from the Comprehensive Plan, appear not to have been used to the full extent practicable in projecting the best future locations. (E3, 4)

Finding 17: Acreage estimates were arbitrary, with no reference citations for "standard factors." In the Preliminary Land Use Report (Appendix B), the writer refers to a "standard factor of 12%" of residential acreage estimates to be devoted to public facilities, excluding streets. No source for that 12% is cited. Likewise in the same report the writer states that commercial land requirements "are generally stated at 5% of residential acreage," without providing a reference.

In a study for determining similar land use and facility requirements for oil shale impacts in Colorado, a well-known urban planning firm, working with an accounting firm and the Denver Research Institute, came up with different calculations of commercial, residential and public facility land needs.[1] The factors they used varied over a range of development densities, population levels under various scenarios, and public policies. Only in a few categories did the factors agree.

The industrial acreage estimate was set at 60 acres with no apparent justification. Further documentation could have been

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[1]THK Associates, Impact Analysis and Development Patterns Related to an Oil Shale Industry: Regional Development and Land Use Study for Mesa, Garfield, and Rio Blanco Counties, Colorado. (Denver: Colorado West ARea Council of Governments and the Oil Shale Regional Planning Commission, 1974) pp. 22, 27, 30.

provided by citing a professional manual such as DeChiara and Koppelman's Planning Design Criteria for space standards.[1] (E12)

Finding 18: No criteria were provided for defining "developable" or "subdivision-prone" land. Criteria for defining developable land would have allowed review of the definition, and might thereby have allowed identification of additional sites, if standards changed due to engineering or access changes. (E12)

Finding 19: Locational criteria display charts would have helped clarify presentation. Appendix D contains examples of criteria display charts which were developed by this author for land use study in the Uinta Basin. (E12/W1/CH1/C8, 9)

Finding 20: Internal contradictions in assumptions about regulatory policies make it unclear what regulatory controls can be expected, and throw doubt on the reasonableness of the land use patterns identified. At several points the writer of the UBAG plan says that land uses will locate on their own, following laissez-faire economic principles, for a pattern which follows utility and transportation patterns in a sprawl. At other places in the text he states the assumption that industrial location will be controlled by implementation of the comprehensive plan. (E12)

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[1] Joseph DeChiara and Lee E. Koppelman, Planning Design Criteria (New York: Van Nostrand Reinhold, 1966) 646 pp.

Finding 21: A range of policy options was not presented to decision makers. The range of policies required to encourage particular land use patterns to achieve a "desirable" plan should have been presented. Later in the methodology, the modelers would have an idea what the management options were, and a sense of the relative probability of implementation. The lack of such policies led to the lack of serious consideration of land use controls as a management tool (although that was as much due to the prevailing policy as to method). (E12)

Finding 22: Management recommendations should have been submitted for different development magnitudes under alternative scenarios. While time and money constraints limit the extent of analysis which can be considered, an ideal method would have included a follow-through from potential patterns to policy options to action recommendations. In this case, follow-through was not contemplated in the original work plan other than to select a desirable land use plan. An opportunity existed to review more stringent land use controls in the region and to determine whether or not land use controls would need to be enforced in the future. (E12/C8, 9)

Data Inventory Stage

From this section onward, most comments relate to the technical water quality planning conducted by the consultant. The land use analysis conducted by UBAG was an element of the pre-analysis to aid in problem identification and subsequent data collection.

Finding 23: Economic data were combined from several sources, indicating that a wide range of estimates were reviewed for the water quality portion of the planning. For instance, demographic projections were examined from the White River Shale Company, the Ashley Valley Wastewater Facilities Plan by Uinta Engineering and Surveying, OBERS Series E, Socioeconomic Impacts of Oil Shale Development, and the State Planning Coordinator's Office. The final projections were a combination of the above, modified for what the consultant and UBAG expected development to be. Demographic projections from UBAG's UPED model were not used because UBAG disagreed with the numbers. (E3)

Finding 24: Extensive primary data collection was conducted for water quality. Primary data collection was emphasized, in accordance with the specialty of the consultant and the major concern of the planning study. (E4)

Finding 25: Function and structure of the water system were analyzed by simulation modeling--an appropriate systematic procedure for the data available. Nevertheless, the analysis is difficult for lay people to understand without intensive study. This is a problem inherent in the technical planning of any field. The planners did the best they could by publishing all the results. (E7, 12/ Chi 3/ W5/H3/C1, 2, 4)

Finding 26: Limiting factors were identified. The following is a list of the types of limiting factors identified:

Political	---	Attitudes to land use planning
Physical	---	Topographic constraints
Financial	---	Service and construction cost ceilings
Biological	---	Tolerance of aquatic species to pollution
Chemical	---	Capacity of streams to oxidize pollutants
Legal	---	Legislative changes needed to authorize new local controls deemed advisable for controlling pollution (W8)

Finding 27: Analysis of irreversible conditions was also conducted through the simulation model, leading to the same benefits, concerns, and tradeoffs discussed in Finding 25.

Finding 28: Performance standards were the state water quality standards--a valid procedure, recognizing legal factors and tying objectives to alternatives, in a commitment to implement the plan. (E12/C1, 2, 3, 5/W5, 8/H2, 5/C1, 2, 7)

Criteria Development Stage

Finding 29: Criteria used for evaluation included all those suggested in EPA guidelines.

Concept Development Stage

Finding 30: The plan was developed in conjunction with the Ashley Valley Wastewater Facilities Plan. (E9)

Finding 31: Distinctly separate alternative plans were not developed. Instead, plan elements were interchanged for evaluation, to formulate a single overall plan. This finding is not a criticism; it emphasizes the difficulty of formulating separate conceptual management plans compared to separate spatial urban plans. No graphic displays can summarize the full dimensions and implications of a regulatory management plan.

UBAG could have formulated three or more plans, each different from the others in some basic policy level emphasis. UBAG could then have compared the overall benefits and disadvantages of each. However, it would have cost much more money and distracted planners from the more indepth technical analysis. Given the same amount of time and money, they were able to get much more detail out of the approach they used. (E7)

Finding 32: Manipulation of land use patterns to control water pollution was not seriously considered as a management strategy. This probably was caused primarily by local resistance to land use planning, but should at least have been included to demonstrate that the alternate strategy was reviewed. (E7)

Concept Evaluation Stage

Finding 33: Public participation and cost effectiveness analysis were conducted seriously. Public meetings were held throughout the

study, and cost effectiveness evaluation constituted an entire volume of the report. (W4/Ch7/C10)

Finding 34: The impact evaluations for technical and institutional alternatives were extensive, although many were brief. In a several-page "Impact Summary" the social impacts were listed in one paragraph, and included only the need for attitudinal changes about land use through education. Likewise, economic impacts were listed in one paragraph, and only three types of costs were listed. The conclusion was that economic impacts would be negligible (see Finding 36). (E7)

Finding 35: Evaluation of benefits, costs, and distributional effects for the overall plan was not conducted. This shortcoming is not unique to this plan. The same comment was made about the California Coastal Plan, and others.[1] Techniques for such large-scale evaluations of natural resource management plans are difficult, expensive, time-consuming, and still subject to substantial controversy. (E7, 11)

Finding 36: Secondary effects were not evaluated in depth. For instance, the effect of the National Pollution Discharge Elimination System Permits required for industrial plants could be to

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[1] Institute for Contemporary Studies, The California Coastal Plan: A Critique (San Francisco, Institute for Contemporary Studies, 1976) 199 pp.

concentrate new development near water and sewer, rather than at locations where other benefits are suitable. The long term effects of such a shift to prime locations might be to drive up the price of land around the locations, forcing out residential and commercial land uses, and changing the overall land use pattern. In the Ashley Valley this might work to disperse subdivisions farther out, increasing the distance of utility lines and service routes and raising the costs of municipal services.

Another example is the potential effect of putting water and sewer service into the Maeser area and reinforcing development patterns there. The wastewater facilities plan states that the eight and ten inch sewer lines planned are for areas which have severe building restrictions and will require extensive use of fill material for solid foundations. The soils maps for the comprehensive plan indicate that better soils exist nearer Vernal. The plan did not investigate alternative sites for housing where costs might not be so high.

Construction of facilities in a pattern not in accord with the pattern recommended in the comprehensive plan is clearly a deviation from the earlier prescribed land use, based on the professional analysis. But it is not clear whether or not a plan which has not been enforced is a violation of the guidelines. Considering the step-by-step review provided by the consultants with UBAG commissioners, the pattern is probably based on existing policy.

By not discussing the secondary impacts of the utility pattern on land use patterns, the utility design engineers have reinforced an implicit decision on the future development pattern. Thus, the methodology has, as in several other tasks described above, influenced the content of the final products. (E8, 10, 11/Ch6)

Selection and Implementation Stage

Finding 37: Implementation tools suggested in the plan are varied and flexible. The plan contains at least fifteen specific actions, thirteen of which are listed under Finding 39 of this chapter. A considerable number of other alternatives were described in the institutional analysis in Interim Output No. 12. The final plan combines regulations with engineering techniques and with education. It even suggests filing nuisance suits, when necessary.

The package of implementation tools is also flexible in that some tools may be preferentially exercised, based on administrative discretion. (W7/Ch4)

Finding 38: Plan elements are politically acceptable, fostering implementation. Since the plan was reviewed step-by-step, with many interim outputs, and the consultants kept a careful tab on the political stance of the UBAG commissioners, the recommendations are realistic. That is one of the main strengths of the plan. There is a high probability that the plan will be implemented because it will have the support of the governing board. (Ch5/H5).

Finding 39: An implementation schedule is provided, in accordance with EPA guidelines. Some of the implementation actions include the following: evapotranspiration systems for septic tanks, building permit coordination with sanitarian, farmer education programs on runoff control techniques, grant program for farmlot control, NDPES permits, legislation to change mining reclamation and oil and gas laws, subdivision ordinance amendments to incorporate best management practices, complete feasibility studies for rural solid waste collection, grants and education for irrigation return flow control, nuisance suit filings, and completion of hydrographic studies and projects. (E13)

Finding 40: UBAG does not have binding legal power to force implementation. UBAG was named the agency responsible for implementing the plan, but councils of government (COG's) have only coordination authority. They have no ability to generate revenues, levy fines, legislate, or enforce regulations. If the implementation does not require any of these activities, the arrangement will probably be satisfactory, since UBAG has been most actively involved in preparation of the plan and probably understands the components and their intent better than other agencies. (E14/Ch2, 5/H1)

Summary

Overall, the water quality planning in the Uinta Basin was well conducted. Several elements of the methodology could have been

improved. The scope, depth and complexity of water quality planning in the Ashley Valley made project management a difficult job. Some of the difficulty is inherent in the legislative mandate, some from the EPA regulations, and some from the lack of clarity and specificity in the work plan. Project management might have been improved by more explicit and detailed work planning, diagramming of the informational relationships and flows, and a better focused effort on integrating the land use analysis with the water quality analysis. This could have been encouraged if central project management had been stronger and more explicit, and if the manager had been more familiar with land use analysis.

The main limitation to the land use analysis was a simplistic approach, which did not recognize the potential for alternative scenarios, alternative regulatory policies, or alternative land use patterns that could affect the subsequent analysis of water pollution locations. Documentation and justification of assumptions and standards were lacking, and the logic sequence was fallacious. Considering the uncertainty due to changing conditions, the land use analysis was not given a significant role in the original work plan, compared to the relative significance of land use to water quality. The work plan deemphasized a sophisticated and intensive land use analysis in favor of extensive water sampling and institutional analysis, in accordance with the specialty emphasis of the consultants.

Despite these constraints, the water quality planning methodology as a whole was conducted reasonably well. Virtually all of the work plan commitments were fulfilled, and EPA was apparently satisfied with the products. The substantial attention paid to quantitative analysis, public participation, cost effectiveness evaluation, and political feasibility resulted in a plan which is likely to be implemented. However, the plan is still based on a foundation of narrow assumptions, which might make it susceptible to rapid outdating if other scenarios, policies, or land use patterns occur. Contingency plans were not specifically formulated.

If the water quality planning is to be continued and updated, supplemental recommendations should be developed to deal with potential changes in locations and magnitudes of development. Scenarios need to be defined, along with indicators which can highlight the approach of threshholds to housing and utility capacities and water supply. Such indicators might be oil shale market levels, population size, new housing construction levels, building permit applications, and staff ability to deal with the changing demands of growth management.

A regional development strategy should be prepared to deal with the integration of the water quality plan with other functional plans. The regional strategy could be the forum within which to review alternative scenarios, land use patterns, capacity problems, and management techniques, and to gather additional natural resource data.

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APPENDICES

Appendix A

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 1. STUDY INITIATION & PROJECT MANAGEMENT

Work Elements

a. Study Organization

Purpose: (1) Establish organization and study work program
(2) Organize 208 citizen advisory committee

Scope: The development of an organization to conduct the post-application phase of the work and to conduct the 2-year 208 program.

Output: (1) An organizational structure for the technical program management and conduct of this program.
(2) An organizational structure for the citizen advisory committee.

b. Assemble Technical Library

Purpose: Develop a comprehensive data base to be utilized throughout the continuing water quality management planning process.

Scope: Information Sources:

Federal and state agencies
Universities
Related water quality management Information and technical information

Task 1. STUDY INITIATION & PROJECT MANAGEMENT (continued)

Work Elements

Professional societies	(303e) NPDES Permits
Trade associations and manufacturers	(303e) Colorado River Basin Plan
Private institutions	Private companies
	Oil field activities--oil shale, tar sands, phosphate development

Output: To develop a complete technical and management library of available data and information relating to water quality management subjects which can be used through the planning process and in future updates and monitoring.

c. Citizen Participation Program and Project Coordination

Purpose: Provide a continuous ongoing program whereby citizen input into the study and planning process can be achieved.

Establish a coordinating program and agreements with loca, state and federal agencies for the UBAG 208 program.

Scope: Contact and work with interested private citizens and citizen groups, generating a role of knowledge and advice for this study. Individuals and groups would take part in the conduct of the study.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 1. STUDY INITIATION & PROJECT MANAGEMENT (continued)

Work Elements

The UBAG staff, study consultants, local, state and federal agencies must work in close cooperation to efficiently integrate their numerous interests and programs into a viable 208 program.

Output: A continuance throughout the UBAG region of citizen participation in the planning program.

A program of coordination and communications among UBAG, local, state and federal agencies during the 2-year course of the 208 program.

Task 2. PLANNING DATA

a. Assemble Existing Water Quality Data

Purpose: To identify the existing water quality and quantity data and assemble these data into a working format.

Scope: Collect the available historical data for water quantity (hydrology) and quality for the study area.

Task 2. PLANNING DATA (continued)

Work Elements

Output: An assembly of existing water quantity and quality data.

b. Assemble Water Quality Standards and Quality Criteria

Purpose: Identify and assemble all applicable state and federal water quality standards.

Scope: Existing and proposed water quality standards are to be collected and reviewed. Areas of deficiency or ambiguity tentatively identified and steps initiated to clarify standards in effect in the study area.

Output: A summary of existing state and federal water quality standards and criteria, including the interim standards currently established as steps to the 1983 standards and goals. A summary of areas of deficiency and a framework for establishing additional areawide standards as a possible outcome of the 208 plan.

c. Inventory of Existing Discharges (Point and Non-Point)

Purpose: To tentatively identify existing and suspected point and non-point sources of pollutants to assist in the identification of the additional field work, sampling and testing necessary to quantify these pollutant sources.

Task 2. PLANNING DATA (continued)

Work Elements

Scope: All existing waste treatment facilities (municipal and industrial) will be inventoried. Areas of existing or suspected non-point pollution sources will be identified and tentatively evaluated as to significance and need for additional investigation.

Output: A working report that inventories and tentatively evaluates the point and non-point pollution sources in the study area and their water pollution impacts.

d. Identification of Receiving Water Conditions, Establishment of a Detailed Water Quality Investigation and Data Collection Program

Purpose: Development of a sampling and monitoring program that will provide a sound basis for rational eveolvement of alternative water quality management plans.

Scope: The existing hydrologic and water quality data shall be evaluated for the waters in the study area, including groundwaters. Data and information deficiencies as related to projected land use patterns, water quality problem areas, and point and non-point pollution sources shall be identified. A sampling and investigation program shall be established to provide the basic water quality and aquatic habitat information necessary to provide a sound foundation for control of pollutants, waste load allocation, etc.

Output: A detailed technical program of water quality subprojects, investigations, and general water quality data collection including a system for periodic review and modification of the program as the project proceeds.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 2. PLANNING DATA (continued)

Work Elements

e. Basic Water Quality Investigations and Data Collection

Purpose: Establishment of basic water-quality-related information and collection of facts to supplement existing data; information analysis and interpretation of this information with respect to water quality standards and goals. Development of dynamic ongoing water quality testing program to be carried out in ensuing years.

(1) General Water Quality Sampling and Testing

Scope: "Standard" physical, chemical and biological analysis of the surface and groundwaters of the study area.

Samples of all significant waters where there are inadequate data.

Monthly, weekly or daily samples of problem areas.

Output: Current reports, of routine water quality testing. Additional working reports on areas were intensive sampling is conducted to evaluate special pollution problems. Ongoing water quality testing program to be carried out in ensuing years.

f. Review and Evaluate Current Land Use

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 2. PLANNING DATA (continued)

Work Elements

Purpose: Establish:

(1) A background of past and present comprehensive planning as completed by the three counties.
(2) Regional Land Management Plan Framework

A. Inventory land use information to date

1. Develop base maps
2. Review pertinent planning programs

B. After six months, preliminary conclusions on the relationship between land use and water quality.

C. Look at all users of land in the UBAG area

1. Local, state and federal
2. Study land ownership maps

D. Correlate this information with:

1. Water quality information
2. Air quality/open space
3. Transportation

Task 2. PLANNING DATA (continued)

Work Elements

(3) Complete a regional goals and objectives program (Statement of Policy)

Scope: Identify by county the land use planning programs, correlating this with transportation, open space, housing, natural resources planning. Develop this information by categories consistent with a sound land use and waste modeling system.

Output: Complete mapping of present land use within the three counties consistent with the regional modeling formats.

g. Identify Land Use Constraints

Purpose: Based on the information and results of work element 2.f, identify and analyze constraints to future land use.

Scope: Consideration given to the following:

- Public reaction and support
- Political philosophies
- Natural limitation of topography and environment
- Social-economic constraints
- Analysis of existing land use controls
- Existing governmental management forms
- Industrial development and growth
- Recreation, housing, open space need and intensity

Task 2. PLANNING DATA (continued)

Work Elements

Output: A comprehensive analysis of constraints to future land use.

h. Identify and Evaluate Land Use/Water Quality Relationships

Purpose: Establishment of a basis for generating water pollutant mass emission rates as a function of the land use patterns.

Scope: Review several different methods of linking land use to resulting water-polluting substances. Establishment of the technical basis methodology and "models" to be used in generating the pollution mass emission rates from various alternative land use patterns in the UBAG area.

Output: A working report setting forth the technical basis and recommended approach(es) to land use/water quality relationships to be applied to alternative land use plans.

i. Identify and Evaluate Future Population Projects and Growth Constraints

Purpose: Define those elements which will affect the future land use activity changes within the water quality management planning area which will put additional loads on maintaining water quality standards.

Scope:

Political	Employment
Social, population characteristics	Land use (residential, commercial and industrial)
Economic	Recreation demand, etc.
Natural resources	

Task 2. PLANNING DATA (continued)

Work Elements

Particular emphasis should be placed on the effect that implementation of the 208 plan, local growth policies, plans for attainment and maintenance of air quality and other regional plans for housing, transportation, solid waste management, public investment, or other variables may have on altering the historical trend of population, employment, and land use patterns. This projection section, along with monitoring information and condition information, will be combined to determine future pollution control needs for each stream segment. In general, instream water quality will be related to pollution generation and transport. In the case of non-point sources, projections may be based on average factors to determine waste load generation per unit of activity or upon data gathered by adequate monitoring depending on the nature of non-point source problems in the area. (This information will then be utilized in establishing stream models.)

Output: A working report of population projections and possible development alternatives from which point and non-point pollution outputs may be projected.

j. Identify Energy Related Relationships

Purpose: To identify effects on surface water and groundwater quality of energy related operations and facilities.

Scope: Review and evaluate ongoing and completed studies and reports on the effects on water quality of development of energy resources. Identify effects of injection wells, surface and subsurface runoff related to exploration and development of oil sands and oil shales.

Task 2. PLANNING DATA (continued)

Work Elements

Output: A working report that identifies and tentatively evaluates water quality problems which may occur as the result of the development of energy resources.

k. Investigate Land Use Modeling System

Purpose: To provide an analytical tool for evaluations of existing and alternative future land use plans according to growth potential.

Scope: Investigate and evaluate a number of modeling software systaems designed to meet future planning needs.

Output: Operation of a dynamic land use system (ongoing) that will provide management information for elected officials to determine future growth needs and when it will occur for both urban and watershed areas.

l. Develop Alternate Land Use Plans

Purpose: Identify the most feasible land use alternatives.

Scope: Bring together the preceding work elements in synthesizing the social, economic, political and environmental factors affecting future land use patterns.

Output: Alternate land use plans for evaluation by citizen groups and elected officials.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 2. PLANNING DATA (continued)

Work Elements

m. Investigate and Implement Water Quality Program

Purpose: Quantification and evaluation of the point and non-point pollution problems and the water quality resulting from present and future alternate waste loads.

Scope: The waters will be evaluated in light of: the nature and magnitude of the pollution loadings; the hydrology and characteristics of the major streams, rivers and lakes the preliminary information generated from earlier tasks; and the difficulty of evaluating the water quality cause and effect relationships. A program will be selected with the specific goal of providing practical results and, in general, the most simple system commensurate with the data and descriptive parameters available or reasonably attainable will be used.

Output: A water quality program that encompasses existing conditions and that is capable of readily accepting alternate future flow and waste loading conditions and then reliably predicting the resulting water quality for the parameters of concern.

n. Select Desirable Land Use Plans

Purpose: To provide a data base suitable for water quality management impact analysis.

Scope: Selection as supported by professional, community agency, and putlic input.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 2. PLANNING DATA (continued)

Work Elements

Output: Data base and graphic representations of selected land use plans.

o. Project Water Quality Impact for Selected Alternative Land Use Plans

Purpose: To quantify potential point and non-point loadings based upon the selected land use plan. (Based on work element 2.h.)

Scope: Consideration of all pollutant sources and quantification of output, including such items as:

Organic materials
Solid wastes
Toxic elements
Inert sediments
Infectious agents
Chemical nutrients
Heat

Output: Tabulation of potential pollutants and water quality problems based upon the selected alternate land use plans.

Task 3: IDENTIFY RESERVOIR, STREAM AND GROUNDWATER SEGMENTS

a. Identify Effluent Limited Segments

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 3: IDENTIFY RESERVOIR, STREAM AND GROUNDWATER SEGMENTS

Work Elements

Purpose: To establish those river or stream segments that will be effectively treated by controlling point source pollutants.

Scope: All stream and river segments.

Output: Inventory of all stream segments that fall into this category for the purpose of applying best practicable treatment of all point sources by 1977.

b. Identify Water Quality Limited Segments

Purpose: To identify all river and stream segments that will be in violation of water quality standards even after all point discharges receive treatment at least as stringent as required by Section 301 (6) (1) of the Act. (PL 92-500)

Scope: All stream and river segments.

Output: Inventory of all water quality limited segments. (Emphasis on 1983 water quality goals.)

c. Compile Total Current Maximum Projected Daily Loads

Purpose: To identify all water quality limited segments according to their pollution levels and types--both current and projected.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 3: IDENTIFY RESERVOIR, STREAM AND GROUNDWATER SEGMENTS (continued)

Work Elements

Scope: All pertinent water quality parameters.

Output: All water quality limited stream segment pollution loads current and projected.

d. Identification of Each Parameter and Its Source Which is in Violation of Water Quality Standards

Purpose: To inventory all violation types and sources.

Scope: All pertinent water quality parameters.

Output: All water quality limited pollutants and sources.

e. Collect Existing Systems Data

Purpose; To inventory and analyze all structural facilities relating to point and non-point discharges.

Scope: Same as work element 2.c, but broadened to include additional information generated in the study.

Output: A comprehensive report on existing structural systems in the area, including an analysis of the operating levels and efficiencies and additional improvements which can be applied to achieve better efficiency.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 3: IDENTIFY RESERVOIR, STREAM AND GROUNDWATER SEGMENTS (continued)

Work Elements

f. Catalog All Available Control Technology

Purpose: To identify available water quality control systems, including advanced technology, which may not yet be operational.

Scope: To be accomplished in conjunction with engineering consultant.

Output: Identification and evaluation of all control systems and a determination of their general applicability for use in the study area.

g. Select Eligible Sets of Waste Load Allocations Current and Projected

Purpose: To determine alternative levels of waste loads that can be achieved by applying various controls.

Scope: Waste load allocations for each point and non-point source as determined by feasible combinations of control.

Output: Alternative measures of control which achieve best cost-effective allocation of waste loads between all point and non-point discharge current and projected (waste load allocation by segment).

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 3. IDENTIFY RESERVOIR, STREAM AND GROUNDWATER SEGMENTS (continued)

Work Elements

h. Test Sets of Waste Load Allocation to Determine if They Result in Meeting Standards

Purpose: Selection of most cost effective method of waste load allocation meeting standards.

Scope: As in 2.g.

Output: Sets of waste load allocations using most cost-effective measures to achieve standards.

Task 4. COORDINATE RESOURCE DEVELOPMENT PLANS

a. Inventory Resource Development Plans

Purpose: To identify and collect all ongoing and/or planned resource development plans.

Scope: Contact all resource development firms and agencies involved, such as:

Oil companies
Oil shale companies
Phosphate Companies, etc.

Task 4. COORDINATE RESOURCE DEVELOPMENT PLANS (continued)

Work Elements

Output: To develop a complete inventory of available data and information concerned with resource development in the study area.

b. Integrate Resource Development Plans

Purpose: To integrate into the water quality considerations the effects and results from resource development.

Scope: Consideration of resource development plans on land use and water quality.

Output: An integration of resource development plans into the land use-water quality relationships previously developed.

c. Determine and/or Review Environmental Impact of Resource Development Plans on Water Quality

Purpose: To determine and/or review the potential environmental impacts from resource development on water quality.

Scope: Review or analyze existing inventoried reports, data, and other information, as required.

Output: An assessment of potential environmental impacts on water quality caused by resource development plans.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 5. ALTERNATIVE TECHNICAL PLANS

Work Elements

a. Develop Alternative Basin Technical Plans

Purpose: To develop feasible alternatives for technical control of pollutants.

Scope: Consideration of the following areas:

Continuous point source sub-plans
Intermittent point sources
Non-point source sub-plans

With respect to wasteload characteristics, costs, reliability, environmental effects, and contribution to overall area-wide goals.

Output: Alternate basin plans for each sub-element within the water management area in regard to control of pollutants.

b. Review Sub-Plans to Select Leading Alternative Sub-Plans Consistent with Eligible Waste Load Allocations

Purpose: To select best sub-plans.

Scope: Sub-plan should be geared to available means of control.

Task 5. ALTERNATIVE TECHNICAL PLANS (continued)

Work Elements	
Output:	New set of controls for sub-plan to provide a higher degree of water standards.
c. Combine Sub-Plans into Alternative Areawide Plans Consistent with Eligible Waste Load Allocations	
Purpose:	To devise a new alternative areawide control plan which will improve water quality and meet waste load allocation standards.
Scope:	Consideration of all relevant material previously developed.
Output:	Acceptable alternative control to achieve waste load allocation standards.

Task 6. MANAGEMENT PLANNING

The management system in the UBAG area must be capable of implementing the areawide plan. This will require an integration with the technical planning process.

a. Inventory Existing Government Structures and Their Management, Financial, and Administrative Legal b. Functions and Capabilities for Implementation of the Plan	
Purpose:	To identify all agencies within the planning area which affect or potentially affect water quality, and all existing management, financial administrative legal functions, and capabilities which have potential for utilization as part of the water quality management process.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 6. MANAGEMENT PLANNING (continued)

Work Elements

Consideration of Scope:

A. Laws (federal, state, local) under which organized:

How financed	Organizational charter
Services provided	Service area
Legal restraints powers	Fiscal capabilities/potential

B. Management regulations
Identify federal laws of regulations
Identify local laws of regulations
Evaluate existing applications
Evaluate existing effectiveness
valuate potential applications

C. Financial resources and inter-relationships, existing and potential:

Federal programs	Historical
Private financing	Federal-state interrelationship
Local	State-local interrelationship
	Local-local interrelationship

D. Administrative structures, existing and potential

Task 6. MANAGEMENT PLANNING (continued)

Work Elements

Output: Overview of existing agencies capable of affecting water quality management; and summary of legislative tools currently available for application to water quality management, synopsis of areawide funds management and funding potential. This would include citation of legal authority and restraints, internal organization, policy guidelines, service area circumscribed, fiscal framework, and services provided.

c. Evaluate Area's Experience and Potential for Required Water Quality Management and Planning

Purpose: To define existing and required management and planning potential and authority, existing and required legal authority, existing and required institutional arrangements, existing and required financial arrangements. Management includes more than treatment of wastes. Provision must be made within the management system for the performance of such other essential functions as the administration of stormwater runoff and non-point source control.

Scope: Evaluate management, planning, engineering, legal, institutional and financial experience and potential.

Output: Most efficient management and planning, engineering, legal, institutional and financial possibility for areawide management.

d. Identify Management System Alternatives

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 6. MANAGEMENT PLANNING (continued)

Work Elements

Purpose: Provide alternative management systems for further evaluation with respect to tal area water quality m anagement. Based on the previous analysis and evaluation of the current status, modifications will be considered leading to a new or improved system of management.

Scope: Consideration of all possibilities, including:

State
Existing facilities
Federal
Potential systems
Combinations of existing and local entities (Timp Planning Association, Snyderville Sewer District)

Output: Comprehensive analysis of all systems capable of meeting water quality management objectives.

Task 7. DEVELOP COMBINED TECHNICAL AND MANAGEMENT PLAN ALTERNATIVES

a. Develop Combined Technical and Management Plan Alternatives

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 7. DEVELOP COMBINED TECHNICAL AND MANAGEMENT PLAN ALTERNATIVES

Work Elements

Purpose: To limit the large number of potential alternatives for pollution control and management to a reasonable number of consistent alternatives for further evaluation.

Scope: Encompasses the consideration of all relevant information previously developed.

Output: Develop combined technical and management plan alternatives--organize the potential alternatives for pollution control and management into a reasonable number of consistent alternatives for further evaluation.

Task 8. EVALUATE ALTERNATIVES

a. Evaluate Monetary Costs

Purpose: Assess the cost effectiveness of each alternative technical and management plan.

Scope: Assessment of all direct resource costs that can be evaluated in monetary terms.

Output: An assessment of cost effectiveness for each alternative plan.

Task 8. EVALUATE ALTERNATIVES (continued)

Work Elements

b. Evaluate Social, Economic and Environmental Effects

Purpose: To assess the potential social, economic and environmental impact of each alternate plan.

Scope: All related elements of the social, economic and environmental aspects of the alternate plans. Environmental review will be general for this study and individual facilities (E.I.S.) will be provided at the time specific design and engineering is undertaken.

Output: An overview of the social, economic and environmental advantages and disadvantages of each alternate plan.

c. Evaluate Financial Feasibility

Purpose: To assess the financial resource capability necessary for each alternative plan for implementation.

Scope: Consideration of:

Internal potential	State	Private	Interrelationships
Federal	Local	Financial	

Task 8. EVALUATE ALTERNATIVES (continued)

Work Elements

Output: An overview of advantages and disadvantages of financial aspects associated with each alternative plan.

d. Evaluate Administrative and Legal Factors

Purpose: To assess the potential administrative viability of each alternate plan.

Scope: Existing legislation, political, legal, geographic, manpower resources, institutional arrangements.

Output: An overview of the advantages and disadvantages of administrative and legal factors associated with each plan.

e. Evaluate Public Acceptance, Relative Values, Reliability, and Other Previously Identified Evaluation Criteria

Purpose: To assess potential of each alternate plans.

Scope: Integrate with public participation program.

Output: The most acceptable alternatives based on these criteria.

UINTAH BASIN ASSOCIATION OF GOVERNMENTS

TABULAR SUMMARY--208 WORK PROGRAM

Task 9. SELECT FINAL PLAN

Work Elements

a. Select Final Plan

Purpose: To identify the most desirable plan which can be effectively implemented.

Scope: Consideration of all important variables which must be weighed in decision-making.

Output: Final plan.

Task 10. DEVELOP DETAILED DESCRIPTION OF PLAN FEATURES

a. Develop Detailed Description of Plan Features

Purpose: To develop in more detail parts of the plan that may not be clear, and how plan may by implemented.

Scope: Analysis of selected plan for detail improvement and stage implementation.

Output: Sequence of plan implementation.

b. Correlate Facilities Planning

Task 10. DEVELOP DETAILED DESCRIPTION OF PLAN FEATURES (continued)

Work Elements

Purpose: To incorporate preliminary engineering studies and environmental assessment for needed facilities into 208 plan.

Scope: Using the material produced in the 201 planning process, those facilities required to 1983 will be included in the 208 planning study. Studies will include basis data on plant size, type of treatment, costs, and environmental impact assessment.

Output: Preliminary estimate on individual facility needs as required to meet 1983 standards.

c. Implementation Priorities

Purpose: To select the schedule for plan implementation.

Scope: Use plan outputs such as facility requirements, nonstructural controls, needs, etc. The various elements will be placed in order of priority with increasing specificity in the short run.

Output: Implementation schedule with priorities.

d. Regulatory Programs

Purpose: To devise any needed programs to regulate water pollution control.

Task 10. DEVELOP DETAILED DESCRIPTION OF PLAN FEATURES (continued)

Work Elements

Scope: In conjunction with federal, state, local regulating agencies, devise regulations to include:

Identification, evaluation and control of point and non-point pollution sources.
Facility location, modification, and construction.
Industrial and commercial pretreatment.
Land use policies and controls.

Output: Regulatory programs to protect ground and surface water.

Task 11. INITIATE LEGISLATIVE ACTION, IF REQUIRED

a. Initiate Legislative Action and Update Procedures

Purpose: To establish the legal basis for implementing and updating the water quality management plan.

Scope: Undertake the drafting of any new legislation that might be required at the state or local levels for plan implementation or updating. Explanation of the legislation of public officials.

Task 11. INITIATE LEGISLATIVE ACTION, IF REQUIRED (continued)

Work Elements

Output: Legal framework for plan operation and updating.

b. Plan Update System

Purpose: To design a program to update the plan on an annual basis.

Scope: Examine the process for preparing an annual plan updating program, including determination of the funding necessary, sources of funds, staffing required, along with the necessary data to perform the updating and the time frame for accomplishment.

Output: Procedures for plan update.

Task 12. PUBLISH PLAN AND STANDARDS

a. Prepare Plan Documents

Purpose: To document the plan and planning process.

Scope: Full fledged and summary reports on the plan itself and the procedures followed will be prepared and published. Public presentations and discussions will have taken place throughout the process.

Task 12. PUBLISH PLAN AND STANDARDS (continued)

Work Elements

Output: Adoptable plan.

b. Plan Adoption

Purpose: To have plan adopted.

Scope: Final public hearings on plan.

Output: (1) Adopted plan

(2) Provisions for plan revision and updating

(a) Performance assessment
(b) Procedures for plan revision and updating

(3) Reports

(a) Condensed report on outputs
(b) Full report on planning process

(4) Plan Submission

(a) State of Utah
(b) E.P.A.

APPENDIX B

PRELIMINARY LAND USE REPORT: UINTAH COUNTY

Prepared For The

Uintah Basin 208 Water

Quality Management Program

By

Uintah Basin Association of Governments

February 1976

INTRODUCTION

The present report is intended as a draft document to be utilized as a decision making tool by local city and county officials in land use planning for Water Quality Management. Upon investigation it is desired that a generalized land use document delineating a preferential area for urban growth to the year 1995 be drawn up and officially approved. Basic planning data and suggested alternative land use plans for urban development are here presented to aid decison makers in this task.

I. ECONOMIC ACTIVITY

Types and quantities of land use in any region are largely determined by economic activity. The present economic structure of Uintah County may be described by the distribution of labor force among various economic sectors as shown below.

Employment by Sector in Uintah County - 1975

Sector	# Employed	% of Labor Force	% Change in Labor Force Since 1970
Agriculture	480	8.0	-0.3
Mining	1,070	17.8	0.6
Construction	250	4.2	-2.3
Manufacturing	220	3.7	-2.1
Transportation and Utilities	510	8.5	3.0
Wholesale and Retail	1,190	19.8	-3.4
Finance and Services	1,010	16.8	-4.9
Government	980	16.3	8.1
Unemployed	290	4.9	1.3
TOTAL	6,000	100	

(Source: U.S. Dept. of Ag.; Utah State Department of Employment Security)

The agricultural labor force has dwindled in recent years as many farmers in Ashley Valley have either consolidated or sold out to

urban development. Nevertheless, due to additional rangeland coming under cultivation, county-wide agricultural acreage has increased.

Mining indicates little change in activity since 1970 but the interim has witnessed a boom in the oil industry. Construction, manufacturing, wholesale and retail, and finance and services all show a relative decrease in labor force while transportation is on the rise. A most significant labor force shift may be identified by the tripling of government workers since 1970. These factors all point to a stabilization of recent economic activity and urbanization, but this picture may rapidly change with the initiation of projected economic developments.

It is anticipated that mining will constitute the bulk of future economic activity in Uintah county. The Stauffer Chemical Co., which mines phosphate just north of Ashley Valley, has hinted at a possible expansion of operations. U.S. Steel has also shown interest in phosphate deposits and is proposing a 760 acre operation adjacent to Stauffer. Tar sands are another mining resource located near Ashley Valley. A prototype facility is already operating and Ashley Ridge and tar sands may employ as many as 50 miners when the operation is fully developed.

Oil well drilling was responsible for much of the recent urbanization in Uintah County and will continue at a lesser rate for years to come. The greatest mining potential, however, lies in the development of oil shale.

The White River Oil Shale Project alone will encompass thousands of acres of land and may employ as many as 2,300 workers when fully developed. It is entirely possible that additional oil shale projects will follow, thus creating an overwhelming socio-economic impact upon the Basin.

II. POPULATION PROJECTIONS

Population forecast for the Uintah Basin is highly speculative due to the uncertainties of energy resource development. Alternative population projections have been made by various agencies, taking into account possible degrees of economic development throughout the Region. The following prediction assumes that the White River Oil Shale Project will proceed as planned through 1995. In addition, natural increase and numerous smaller resource developments will occur for a total average increase of 5%/year.

Population Projections: Uintah County

Location	1975	1980	1985	1990	1995
Vernal City	6,405	7,700	9,600	10,900	12,200
Ashley Valley	7,252	8,900	11,000	12,400	13,800
West Side	3,168	4,000	5,400	6,200	7,000
TOTAL	16,825	2,060	26,000	29,500	33,000

As indicated above, Uintah will receive a population increase of approximately 16,175 by 1995. 12,343 persons will locate in the Ashley Valley/Vernal City region alone. With proper planning and intergovernmental cooperation, much of the population designated for Ashley Valley (unincororated) may be channeled into Vernal City where services are more readily available.

III. EXISTING LAND USE

Vernal City and unincorporated Ashley Valley will be considered as one contigous region for purposes of Water Quality Management land use planning. Being an area of relatively intense settlement, the Ashley Valley region requires close analysis with respect to existing land use, and upon inspection yields the following acreages.

Current Land Use Acreage in Ashley Valley

Land Use	Unincorporated	Vernal City	Total	%
Urban	4,457	1,054	5,511	8
Agricultural	28,706	695	29,401	40
Rangeland	30,907		30,907	42
Forest	5,534		5,534	8
Water	1,515		1,515	2
			72,868	100

One may note that agricultural land and rangeland retain high aerial coverage and that urban acreage largely occurs in the unincorporated area. Although zoned for agricultural use, the unincorporated valley has been severely dissected by sprawl as a result of low minimum lot size requirements. Land zoned for urban use lies in and around Vernal City and much undeveloped vacant land for residential growth is present due to an aggressive municipal policy of annexation. A central business district continues to dominate the heart of Vernal, but strip commercial development is gaining momentum along the eastern highway entrance. A highway zone trisects

the Valley, indeed the County, but is largely undeveloped outside of settlement cores.

A second region of urban land use concern is the West Side, located in the northwestern portion of Uintah County. Although approximately three times the size of Ashley Valley, the West Side is sparsely populated and is largely landscaped by agricultural plats interspersed by overgrazed rangelands. Several small farm communities are present and isolated farmsteads dot the countryside. The West Side is entirely zoned agricultural except for a small commercial district in each town and the bisecting highway zone. Urban density is increasing along the highway zone, especially in proximity to the Indian Community of Ft. Duchesne and nearby Roosevelt City, but remains less significant in the outlying area.

Remaining lands of Uintah County are uninhabited except for occasional ranches, summer homes, and mining camps. There are basically two regions encompassing the remaining area of the County. The northern mountain region is zoned and utilized for recreation, forestry and mining. Aside from a phosphate mine, the only urban element occurs with transient recreation concentrations during summer months.

The second region in question is zoned for mining and grazing and contains the arrid wastelands of a structural basin fringed by mountains on its southern and northern margins. An oil well concentration is located in the vicinity of Red Wash, while a small company town of about 20 acres comprises Bonanza, where gilsonite is mined

and processed. The initiation of proto type oil shale mining is producing additional urban type land use in this region.

IV. FUTURE URBAN LAND USE

Information presented in the preceeding sections of this report forms a basis for planning future urban land use in Uintah County. Projected economic activity and population data was consulted in estimating future urban land use requirements. A knowledge of existing economic activity and land use provides guidelines in determining desirable alternative locations for the required urban acreage.

A. Acreage Requirements

In searching for a residential density factor with which to compute future residential acreage for the inclusive Ashley Valley region, the present Vernal City subdivision density of 10 persons/acre was selected with the expectation that greater density developments such as mobile homes and multi-family dwellings will average out with the larger size rural residential lots. It will be recalled that a 12,343 person increase is projected for Ashley by 1995. This translates to a residential requirement of 1,234 acres of which 800 acres are presently available in vacant residential and agricultural lands within Vernal City limits. Thus, only 434 additional residential acres need be identified and designated in unincorporated Ashley Valley. "Residential" acreage estimates already include streets, but additional acreage must be added on to accomodate other public facilities such as parks and public buildings.

Using a standard factor of 12%, it is estimated that 312 acres total land use be devoted to public facilities (excluding streets) in Ashley Valley in 1995. The region already contains approximately 260 acres of public facilities, thus, leaving a future requirement of 52 acres to be designated for public facilities outside Vernal. For general planning purposes this 52 acres public facilities land will be combined with the 434 acre residential requiremnet, thus yielding a total requirement of 486 acres to include housing, streets, and public facilities.

Commercial land requirements are generally stated at 5% of residential acreage. Thus, 129 acres of commercial land will be needed in Ashley Valley by 1995. The region already has approximately 100 acres devoted to commercial. Therefore, only 29 more acres are needed. It is anticipated that presently zoned commercial land may be more intensely utilized to accomodate this requirement and no new commercial land will therefore be designated.

Industrial land requirements vary from place to place depending on type of industry and its functional importance to a region. It is difficult to forecast industrial needs of the region and it is apparent that presently zoned industrial land may yet be more intensely utilized. Nevertheless, it is desirable to designate a parcel of land for industrial expansion in order to reverse the past industrial location practice of congesting transportation arteries east of Vernal City. A 60 acre tract will thus be designated for future industrial growth.

No attempt is here made to estimate acreage requirements for growth on the West Side of Uintah County. Increase should be encouraged to locate near existing cluster developments and a small area of expansion will thus be delimitated for each existing non-Indian community. Urban growth should be prohibited in remaining regions of the County with the possible exception of a new town location in connection with the development of oil shale.

B. Acreage Location

Future urban land use patterns in Ashley Valley may be realistically predicted according to land ownership, water and sewer plans, and official planning goals. The primary areas may be identified for consideration of urban growth. The first area is composed of subdivision prone lands within and immediately adjacent to Vernal City. Land owners have designated acreage for development greatly in excess of the 486 acres required for future residential and public facilities land use, however, sewer and water plans were consulted in delimitating a space to include only the projected acreage requirement. A sewer trunk line to be constructed along 500 south in the near future will service development on residential and agricultural zones lying within city limits on the south. In addition, 230 acres of presently unincorporated lands in this vicinity may be designated for residential expansion. The remaining 256 acres of the 486 acre total requirement of unincorporated land may

be designated on development prone lands immediately west of Vernal City where sewer plans call for the extension of 10" and 8" lines (see map #1 for development alternatives in Ashley Valley). Although soils in the southern vicinity of alternative #1 are generally stable, it must be mentioned that soils to the west of Vernal generally have severe building restrictions and will require extensive use of fill material for solid foundations.

A second area for future urban growth lies in the rural neighborhood of Maeser. This area is presently restricted as a result of excessive septic tank concentration, but may again be eligible for development upon construction of sewer lines. Sewer plans make provision for the extension of 10" and 8" lines into the Maeser area upon administrative approval. Any amount of land consumed by development in alternative #2, the Maeser area, should be coordinated with acreage selected from alternative #1 in order to avoid an excessive residential designation. Approximately 200 acres of development prone lands are delimitated for possible urban expansion in the Maeser area (see map #2). The Maeser area also exhibits poor building soils requiring fill material for solid foundations.

The third development alternative arises from a desire to preserve agricultural heartland and includes a residential designation on the periphery of Ashley Valley. Approximately 110 acres have been delimited for development west of Maeser. Any urban land use occurring in the vicinity must be coordinated with acreages in

alternatives #1 and #2 in order to avoid an excessive residential designation. Soils in this third location area are good for building, but a problem arises with respect to water supply. Urban growth at such a high topographic elevation will require the construction of a major water line, and gravity flow from the present water source would be slight, resulting in low water pressure for alternative #3 benchlands, unless augmented through the use of pumps.

It is realized that some development will likely occur in all three of the above alternative locations. A particular alternative may be considered most desirable, however, and through official action be implemented as the dominant land use pattern for future residential expansion.

Industrial growth in Ashley Valley should be encouraged to fill in vacant lands in the present industrial zone. Any additional industrial land which may be required should be located adjacent to the present industrial zone; but not in interference with plans for airport expansion and not directly on major transportation arteries. Approximately 60 acres have been delimitated for industrial expansion immediately east of the present industrial zone, (see map #1). Land in this vicinity is relatively flat and soils are well drained.

Urban growth on the West Side requires designations for future residential location. Based upon physical landscape and present land use, small areas have been delimitated from residential expansion in each existing community. (see map #2). Note: Indian communities are excluded from this project.

APPENDIX C

BACKGROUND ON WATER QUALITY PLANNING

This section reviews the enabling legislation and administrative guidelines which provide the framework for water quality planning. The water quality planning process is described, as well as the informational inputs and product outputs. The process is analyzed for the linkages with land use planning.

Legislative Background

Federal Water Pollution Control Act amendments of 1972 authorizes a continuing planning process, specifies several levels of planning, establishes a permit system, and authorizes significant appropriations for construction of municipal treatment facilities. This is a combined approach to control point sources, such as industrial plants, and non-point sources.

The Act authorizes three geographic scales of planning studies. These are:

1. Regional reconnaisance-level evaluation of river basins. (Same as Level B studies under the U.S. Water Resources Council). (Sec. 209).
2. Drainage-basin plans (Sec. 303(e))
3. Areawide waste treatment management plans (Sec. 203)
4. Facilities plans (Sec. 201)

The Act authorizes a permit system, called the National Effluent Discharge Permit System (NEDPS) to regulate the location of point sources and the quality of discharged effluents. Non-point sources are to be controlled by collector pipe systems, where possible (such as in suburban areas), and by locational incentives, site controls and land use regulations, as appropriate.

Municipal facilities are supposed to be developed in concert with areawide, basin, and regional plans. The end result should be a nested set of plans which are all consistent with one another. Municipal facilities plans and areawide management plans should include evaluations of alternative sites and service areas, environmental impact assessments of collection and treatment works, and analysis of compatibility with land use and transportation plans.[1] Evaluation of plans by EPA is supposed to include an assessment of whether or not the facilities planners actually do conduct such studies.

Under Section 208, each designated area is to develop an "Areawide Water Quality Management Plan." The plan is to be used for recommending a combination of incentive and regulatory techniques for preventing and eliminating existing and future sources of pollution.

Location decisions for new point and non-point sources may be addressed by the various levels of governments through regulations

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[1] Izaak Walton League, A Citizen's Guide to Clean Water (Washington D.C.: U.S. Printing Office, 1973) p. 41.

on siting and the NEDPS permit system. The Water Quality Management Plan therefore necessitates analysis of land use impacts on water quality, and knowledge of legal and politically feasible land use controls.

Land capability is a vital factor in determining where development pressure will take place. If comprehensive plans, based on land capability are enforced, they may be used to determine future locations of development pressure.

EPA has provided guidelines for local planning agencies to gather land use data, and provide basic procedures for coordinating, but the responsibility for consistenty with local plans and enforcement start with the local government. The guidelines suggest the preparation of a management plan to guide the overall planning. Present administrative practices rely on the state and EPA to ensure that the local government selectes a consultant which has the capability of preparing a good management plan.

Planning process design and control is diffused through a variety of players. The technical planning direction is to be provided by local planning agencies, based on procedures manuals prepared by consultants, and approved by administrators in EPA. While local governments have primary responsibility for conducting the studies, states have program approval responsibility. Local governments have implementation responsibility. Federal agencies are asked to participate in meeting water quality standards, especially where

federal lands may be influencing the waters in the study region. Intergovernmental coordinating committees are necessary to identify and control sources of pollution which may be under the jurisdiction of a variety of responsible agencies with differing authority.

Implications for Land Use Planning

The U.S. Senate Subcommittee on Environmental Pollution, which worked on the FWPCA Act Amendments, state that the Congressional intent was to keep land use planning separate but coordinated. "208 planning is not land use planning--though inevitably some communities will choose to develop land use plans as part of the waste management process."[1] However, it could be argued that since the permit system should be based on the results of planning, and since the land use planning will affect water quality and related planning, then 208 planning will affect land use patterns.

The permitting system and facility construction fund are the teeth of the legislation. Industrial plants could be required to site only on water and sewer networks, unless they build in-house treatment facilities to meet discharge standards for receiving streams. Most firms with remote sites, and not financially large enough to build their own systems, would probably purchase a new site closer to the utility networks. The long-term influence could be a

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[1]Leon J. Billings, "Is 208 Planning Land Use Planning?", Journal of Soil and Water Conservation (May-June 1976): 96.

shift in the intra-regional location patterns, including those for housing, schools and hospitals, and businesses in the secondary service sector.

The planning and permitting legislated in the FWPCA will tie land use patterns to utility networks. The influence of facility plans on land use will be expanded, as will be the role of facility planners. The need for increased attention to the detailed mechanics of the planning process to improve coordination is clear.

A specific coordination mechanism was not legislatively required in the Act for proving consistency between assumptions, projections, administrative procedures, or regulations.[1] The only permits which are legislatively required to be consistent are those by EPA itself for construction of facilities, after a plan has already been approved.[2] Therefore, it is important that consistency between plans be assured within the planning process. It is the responsibility of the evaluator agency to ensure coordination.

EPA's Management Planning Guidelines state that:

> The land use aspects of 208 planning provide a direct linkage with other areawide planning efforts within the area, including those supported under the HUD 701, water and sewer, flood insurance and distaster programs, DOT transportation plans, and NOAA coastal management plans . . . 208 planning should be viewed as providing the water quality component of the comprehensive plan for the area . . . The

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[1]The Council of State Governments, Land Use Policy & Program Analysis: Intergovernmental Relations in State Land Use Planning Lexington, KY: Council of State Governments, 1974) p. 9.

[2]Michael Jungman, "Areawide Planning Under the FWPCA Amendments of 1972: Intergovernmental and Land Use Implications" Texas Law Review 54 (Jn 1976):1054

> 208 planning agency should establish procedures to ensure that such plans are consistent with the 208 plan.[1] (Emphasis added.)

Unfortunately, there are inherent difficulties in trying to assess the degree of coordination taking place between planning projects. Many agreements and understandings are made on the basis of phone calls, meetings, workshops that do not get recorded. Sometimes the coordination does not take place at all. The outside monitor cannot tell directly from the reports the extent of coordination. A recent study of HUD 701 Comprehensive Planning programs in the intermountain states said:

> Federal and state descriptions of planning processes are often representative of a desired process rather than actual operations. Processes are often informal, and are frequently "gentlemen's agreements," totally dependent on the personalities involved.[2]

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[1] U.S. EPA, Guidelines for Areawide Waste Treatment Management Planning (Washington, D.C.: Government Printing Office, 1975), pp. 2-6.

[2] Doyle Buckwalter, Rick D. Burtenshaw, and Douglas R. Dickinson, "The HUD 701 Land Use Element: Implementation in the Public Land States." (Salt Lake City: Utah Dept. of Community Affairs, 1976), p. vii.

APPENDIX D

This appendix contains examples of tables for the display of siting criteria which could have been used by UBAG staff in the Preliminary Land Use Report to better illustrate the basis for judgements on future land use locations. Alternative combinations of land use sites yields alternative land use patterns. The important point in these tables is that there needs to be clear evidence of the basis for making judgements about the probability of land being developed. The agency derives better public defensibility of its plan by demonstrating a more rigorous methodology.

These tables were prepared by the author as part of an earlier study in the region with Bishop, et al.[1] and were accompanied by maps showing the locations of alternative sites.

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[1]Bishop, et al. "Environmental Quality Management in a Region with External Development Pressures," (Logan, Utah: Utah State Water Research Lab, 1977) 141 pp.

TABLE 3

SITE ATTRACTIVENESS COMPARISON-WASTEWATER TREATMENT PLANTS

Criteria	Capability Rating						
	A	B	C	D	E	F	G
I. Economic Significance to Developer							
A. Suitability criteria							
1. Minimizes distance from collection area to discharge point	M	H	H	M	H	M	L
2. Equidistant from all collection areas	L	M	H	L	M	H	L
3. Roads to site	L	H	H	H	H	H	M
B. Capability criteria							
1. Soil capability for foundations	H	H	M	L	M	M	H
2. Site off floodplain	H	H	M	M	H	H	H
3. Soil drainage capability	M	H	M	H	H	H	H
4. Slopes flat	H	H	M	M	H	H	H
5. Impermeable base layer	M	M	M	M	H	H	H
6. Low elevation	H	H	M	M	H	H	H
II. Environmental Significance to Region							
1. Avoids aquifer recharge area	H	H	M	M	H	H	H
2. Winds blow away from settled areas	H	H	H	L	H	H	L
3. Minimizes visual impact	H	M	L	L	H	H	L
4. Minimizes conflict with agricultural land	M	H	H	H	L	L	L

Code: A = SE of Roosevelt C = NE of Duchesne E = Naples G = Jensen
B = South of Roosevelt D = SW of Duchesne F = East of Davis

TABLE 4

SITE ATTRACTIVENESS COMPARISON FOR SANITARY LANDFILLS

Criteria	Capability Rating							
	A	B	C	D	E	F	G	H
I. Economic Significance to Developer								
A. Suitability criteria								
1. Equidistant from all communities served	H	H	H	M	H	L	H	H
2. Minimizes transport distance	H	M	H	L	H	L	H	H
3. Close to roads	H	H	H	L	M	H	H	H
B. Capability criteria								
1. Out of floodplain	M	H	H	H	H	H	H	H
2. Permeable cover layer	M	H	M	H	H	H	M	M
3. Good soil depth or soft bedrock	M	H	M	M	M	M	-	-
4. Flat slopes	H	M	H	H	H	H	-	-
5. Not in depression basins	H	H	H	M	M	H	-	-
6. Good soil drainage capability	M	H	M	H	H	H	H	H
II. Environmental Significance to Region								
1. Has an impermeable bottom layer	H	H	M	M	L	M	M	M
2. Wind blows away from civilization	H	H	H	H	M	H	H	H
3. Minimize visual impact severity	M	L	H	M	M	H	H	M
4. Minimize conflict with agricultural land	M	L	M	L	M	H	H	H
5. Avoids aquifer recharge zone	H	H	H	L	M	L	L	L

Code: A = Ashley Creek; B = SW Ashley Valley; C = West Side; D = Pleasant Valley; E = Bridgerland; F = Ioka; G = SW of Talmage; H = South of Talmage; H = High; M = Moderate; L = Low

TABLE 5

SITE ATTRACTIVENESS COMPARISON FOR OIL REFINERIES

Criteria	Capability Rating			
	A	B	C	D
I. Economic Significance to Developer				
A. Suitability criteria				
1. Near pipeline	H	L	M	H
2. Roads to site	H	L	H	H
3. Support activities nearby	L	M	L	H
B. Capability criteria (constraints)				
1. Soil capability for foundations	M[1]	M	M	M
2. Site off floodplain	M	H	H	H
3. Soil drainage capability	H	H	H	H
4. Soils capability for septic tanks	H	M	H	H
5. Slopes flat	H	M	M	H
6. Adequate space available	H	L	L	H
II. Environmental Significance to Community or Region				
1. Avoidance of aquifer recharge zone	M	L	L	L
2. Proximity to air drainage or elevation in basin	L	L	M	L
3. Minimize degree of visual impact	M	M	M	M

Code: A = Lake Bouran
B = Mt. Emmons
C = Upalco
D = Blue Bench
H = High
M = Moderate
L = Low

[1] Information not available for heavy structures on soils